EXHIBIT PICTURES from the FOUR REGIONAL RESEARCH LABORATORIES

Miscellaneous Publication No. 617

Bureau of Agricultural and Industrial Chemistry ☆ Agricultural Research Administration

U. S. DEPARTMENT OF AGRICULTURE

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BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY
AGRICULTURAL RESEARCH ADMINISTRATION
U. S. DEPARTMENT OF AGRICULTURE

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PENICILLIN

MOLD CULTURES DEVELOPED AT THE NORTHERN REGIONAL RESEARCH LABORATORY USED FOR THE COMMERCIAL PRODUCTION OF PENICILLIN.

NORTHERN REGIONAL RESEARCH LABORATORY 1941—45

PENICILLIUM NOTATUM
NRRL 1249.B21
SURFACE PRODUCTION

PENICILLIUM NOTATUM
NRRL 832
SUBMERGED PRODUCTION

PENICILLIUM CHRYSOGENUM
NRRL 1951.B25
SUBMERGED OR SURFACE PRODUCTION

PENICILLIN PRODUCTION FOR 1945

RAW MATERIALS

LACTOSE (MILK SUGAR)
6,000,000 LBS

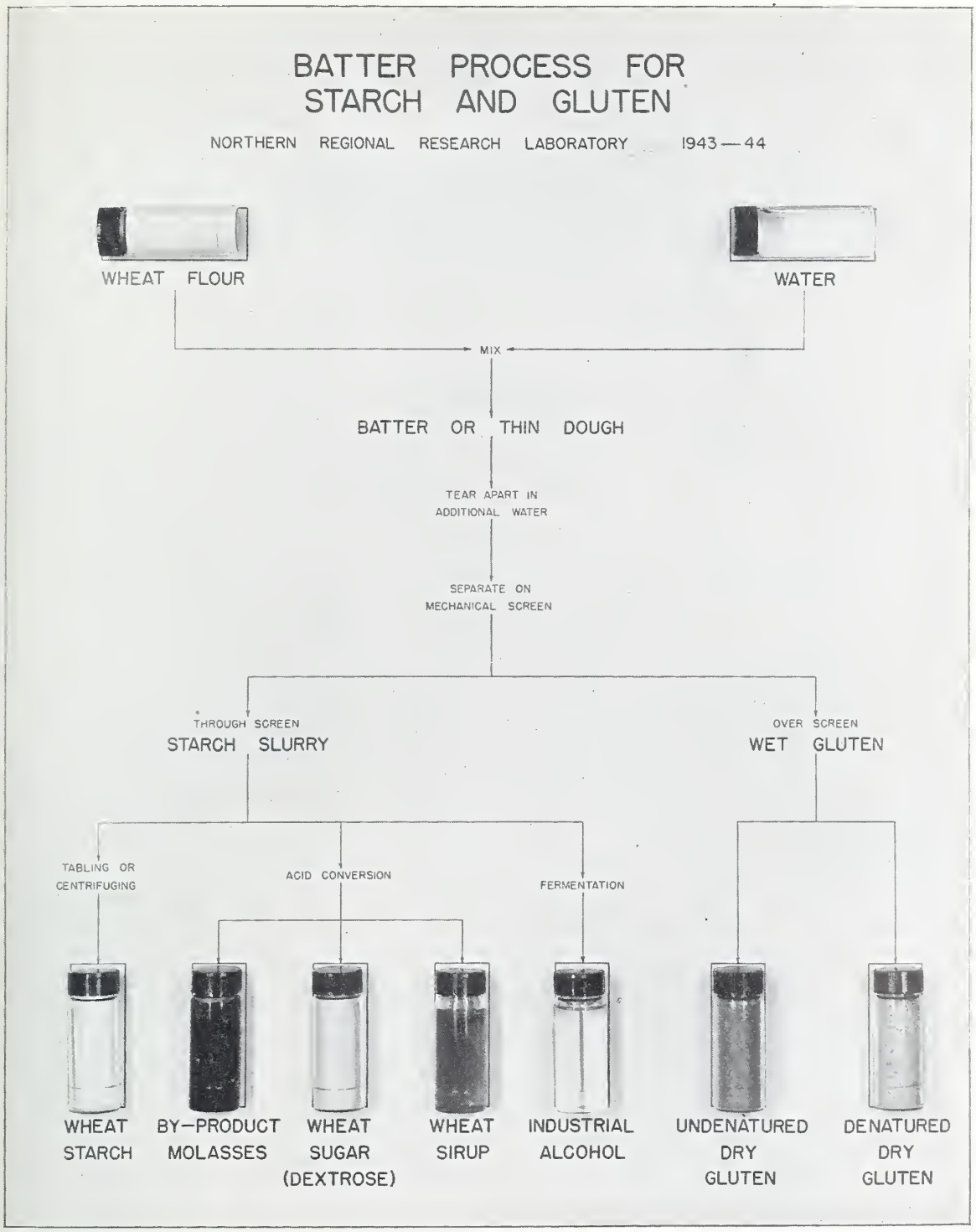
CORN STEEP LIQUOR
12,000,000 LBS.

PURE CULTURE
FERMENTATION

MOLD GROWTH (NRRL 1951.B25)
SUBMERGED CULTURE
IN LARGE TANK

CHEMICAL
PROCESSING

COMMERCIAL GRADE PENICILLIN
4,000 BILLION UNITS
(ENOUGH FOR 4,000,000 HOSPITAL CASES.)


BATTER PROCESS FOR
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NORTHERN REGIONAL RESEARCH LABORATORY 1943—44
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WATER
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TEAR APART IN
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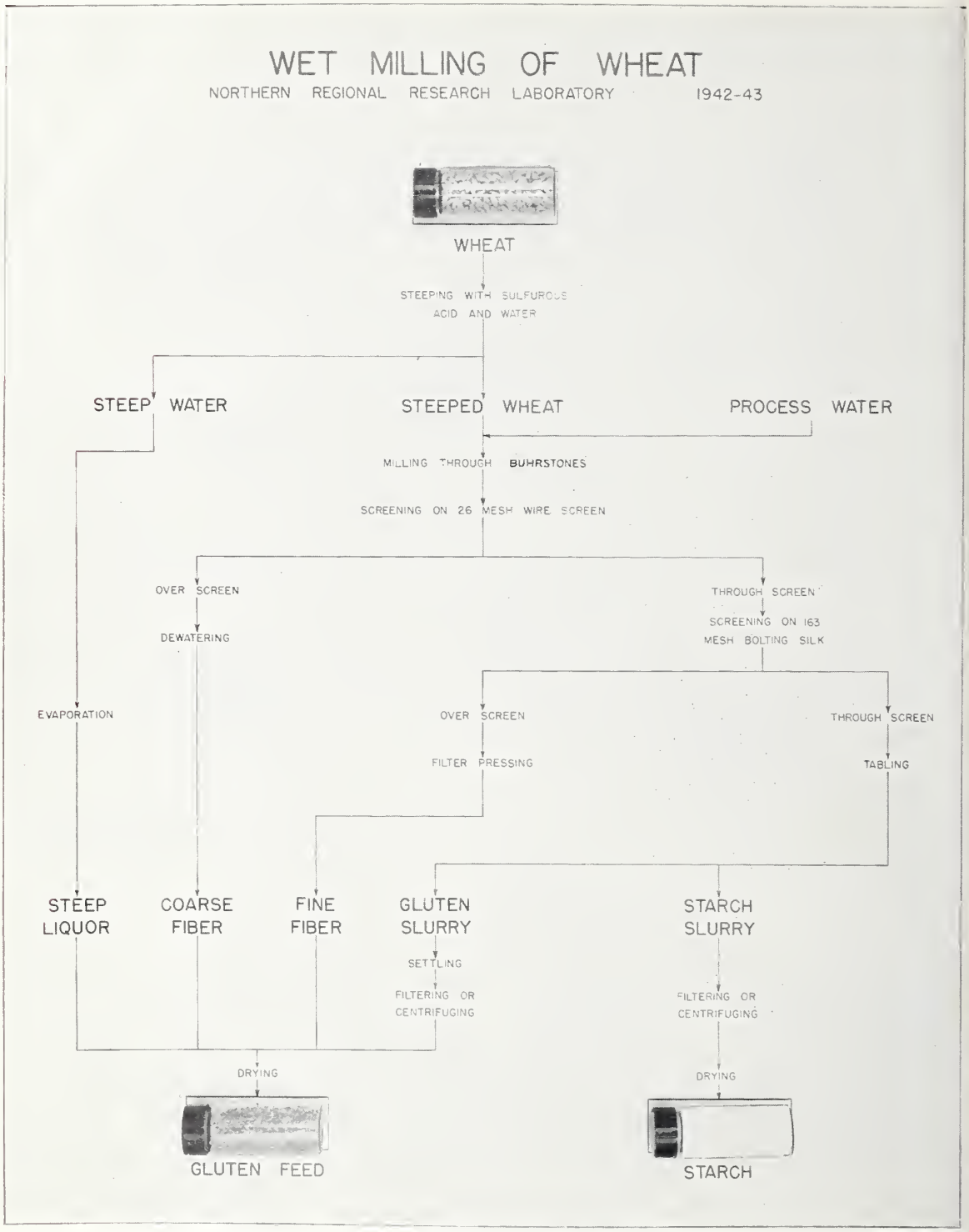
SEPARATE ON
MECHANICAL SCREEN
THROUGH SCREEN
STARCH SLURRY
OVER SCREEN
WET GLUTEN
TABLING OR
CENTRIFUGING
ACID CONVERSION
FERMENTATION
WHEAT
STARCH
BY—PRODUCT
MOLASSES
WHEAT
SUGAR
(DEXTROSE)
WHEAT
SIRUP
INDUSTRIAL
ALCOHOL
UNDENATURED
DRY
GLUTEN
DENATURED
DRY
GLUTEN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OVER SCREEN
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OVER SCREEN
THROUGH SCREEN
FILTER PRESSING
TABLING
STEEP LIQUOR
COARSE FIBER
FINE FIBER
GLUTEN SLURRY
STARCH SLURRY
SETTLING
FILTERING OR CENTRIFUGING
FILTERING OR CENTRIFUGING
DRYING
DRYING
GLUTEN FEED
STARCH

NOREPLAST

AGRICULTURAL-RESIDUE MOLDING COMPOUNDS OF ONE-HALF NORMAL PHENOLIC RESIN CONTENT

NORTHERN REGIONAL RESEARCH LABORATORY 1941-45

AGRICULTURAL-RESIDUE FLOUR: MAY BE FROM CORNCOBS, FLAX SHIVES, RICE HULLS, PEANUT HULLS, CORN STOVER, HEMP HURDS, WHEAT STRAW OR ANY OTHER SIMILAR RESIDUE

50%

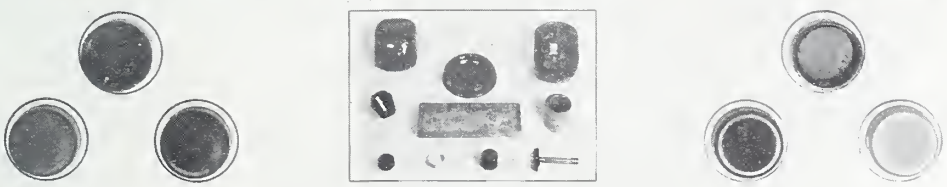
COMPOUNDS WITH ORGANIC PLASTICIZERS AND PHENOLIC RESINS

COMPOUNDS WITH INORGANIC EXTENDERS AND PHENOLIC RESINS

COMMERCIAL LIQUID PHENOLIC RESIN 25%	VINSOL SOAP PLASTICIZER 25%	WATER-PRECIPITATED PHENOLIC RESIN 25%	VINSOL PLASTICIZER 25%	COMMERCIAL POWDERED PHENOLIC RESIN 25%	PRECIPITATED CHALK 25%	IRON OXIDE 25%	DIATOMACEOUS EARTH 25%

PROCESSING OPERATIONS

MIXING ROLLING GRINDING MOLDING



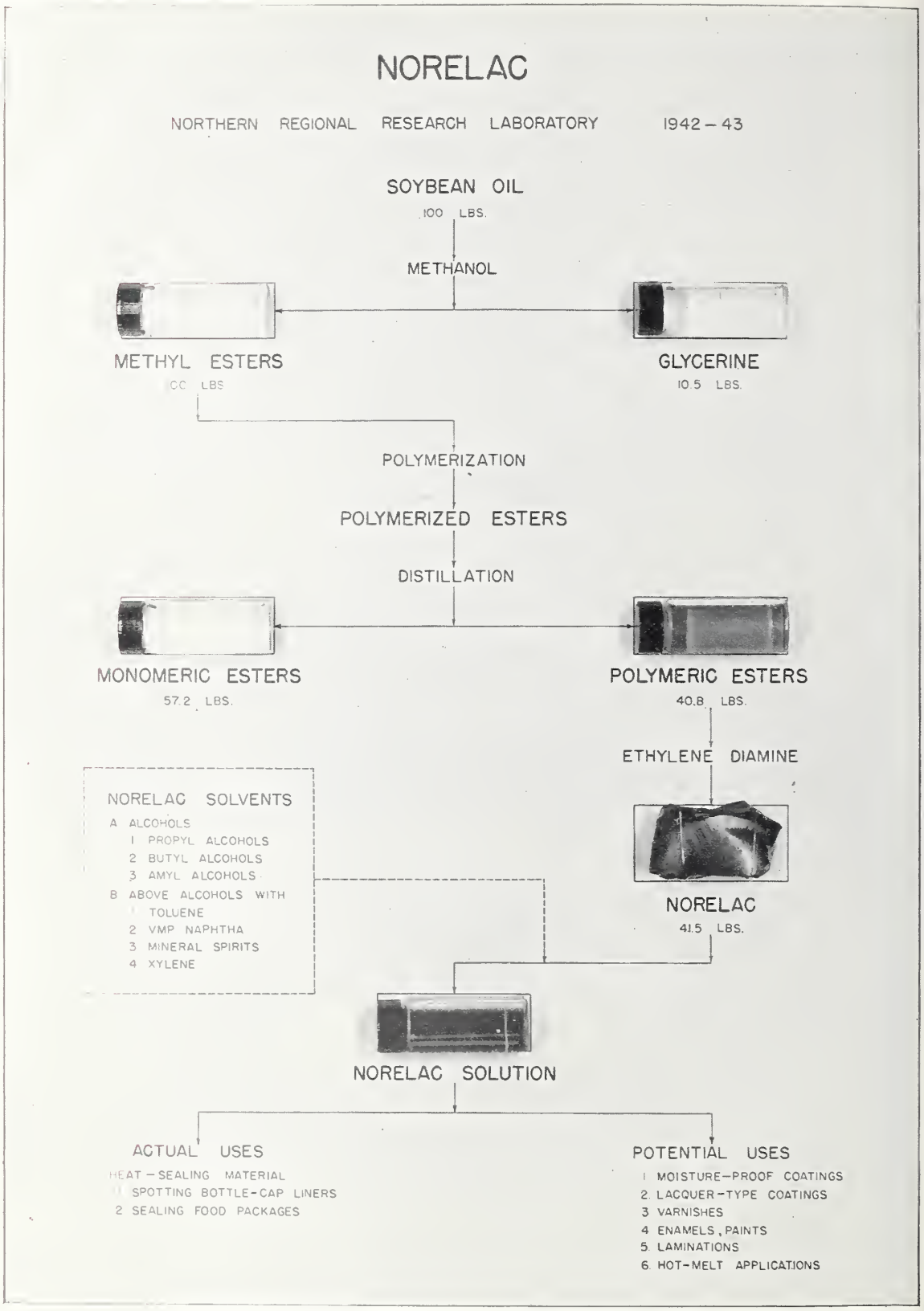
PRODUCTS

—PHYSICAL PROPERTIES—

	FLEXURAL STRENGTH	TENSILE STRENGTH	IMPACT, NOTCHED IZOD	
SPECIFICATIONS, GENERAL PURPOSE PHENOLICS	9,000 P.S.I. MIN.	7,000 P.S.I. MIN.	0.24 FT-LB. MIN.	[illegible]
CORNCOB, VINSOL PLASTICIZED	13,100 P.S.I. MIN.	9,710 P.S.I. MIN.	0.18 FT-LB. MIN.	[illegible]
CORNCOB, CHALK EXTENDED	12,300 P.S.I. MIN.	9,440 P.S.I. MIN.	0.22 FT-LB. MIN.	[illegible]
FLAX SHIVE, VINSOL PLASTICIZED	9,640 P.S.I. MIN.	8,200 P.S.I. MIN.	0.20 FT-LB. MIN.	0.54% MAX.
RICE HULL, CHALK EXTENDED	10,860 P.S.I. MIN.	7,140 P.S.I. MIN.	0.26 FT-LB. MIN.	0.43% MAX.

NORELAC

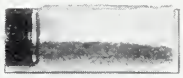
NORTHERN REGIONAL RESEARCH LABORATORY 1942 – 43



NORESEAL

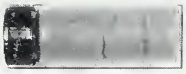
A CORK SUBSTITUTE FOR USE IN THE BEVERAGE AND FOOD INDUSTRIES

NORTHERN REGIONAL RESEARCH LABORATORY 1942–44



HIDE GLUE

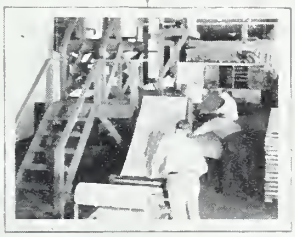
INVERT SUGAR



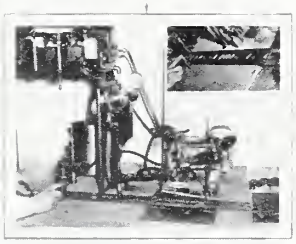
PEANUT-SHELL PITH

PARAFORMALDEHYDE

MIXED WITH WATER
TO THICK AERATED PASTE



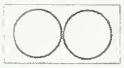
PILOT PLANT FOR MAKING AND DRYING SHEET NORESEAL



PILOT PLANT FOR DISPENSING NORESEAL DIRECTLY INTO CROWNS AND DRYING

NORESEAL-LINED CROWN

SHEETED NORESEAL



"SPOT" MATERIAL

NORESEAL-LINED CROWN

FINISHED CROWN SEAL

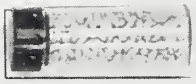
MESO-2,3-BUTYLENE GLYCOL

NORTHERN REGIONAL RESEARCH LABORATORY 1942-44

CORN

BUSHEL

←OR→



WHEAT

BUSHEL

MILLING

MIXING WITH WATER AND ACID

CONTINUOUS COOKING WITH STEAM

NEUTRALIZING WITH CALCIUM CARBONATE

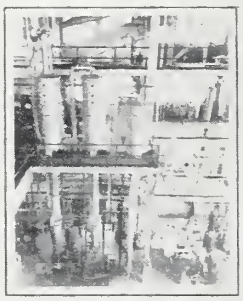
PURE-CULTURE FERMENTATION

EVAPORATION

PURE CULTURE

AEROBACTER AEROGENES

2000 x



EVAPORATOR

CONDENSATE

DISTILLATION

SIRUP

STEAM STRIPPING

VAPOR

SCRUBBING

DISTILLATION

RESIDUE

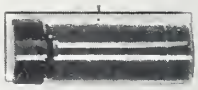
DRYING

190-PROOF ALCOHOL

0.15 GALLONS

2,3-BUTYLENE GLYCOL

14 POUNDS

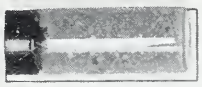


DRIED RESIDUE

20 POUNDS

BY-PRODUCT FEED FROM PENICILLIN WASTES

NORTHERN REGIONAL RESEARCH LABORATORY 1944-45



MOLD MYCELIUM

PENICILLIN WASTE LIQUOR

EVAPORATE TO SIRUPY CONSISTENCY

BLENDING

DRYING

PROTEIN AND VITAMIN CONCENTRATE

PROTEIN	30	PER CENT
RIBOFLAVIN	25- 30	PARTS PER MILLION
NIACIN	160-180	PARTS PER MILLION
PYRIDOXIN	40- 50	PARTS PER MILLION
THIAMINE	3- 4	PARTS PER MILLION
PANTOTHENIC ACID	350-400	PARTS PER MILLION

ZEIN TEXTILE FIBER

NORTHERN REGIONAL RESEARCH LABORATORY 1944-45

CORN

WET-MILLING PROCESS

OIL

STARCH

GLUTEN

ALCOHOL EXTRACTION

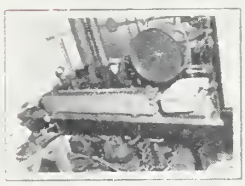
XANTHOPHYLL OIL

GLUTEN RESIDUE

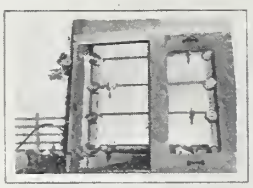
ZEIN

ZEIN

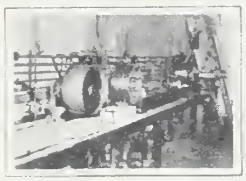
DISPERSED IN AQUEOUS ALKALI



FIBER - SPINNING UNIT

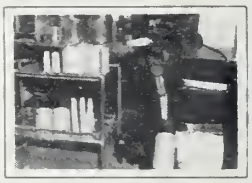


FIBER DRIER



FIBER STRETCHING

EXTRUSION THROUGH SPINNERET



FIBER CONING

DYED FIBERS

RIBOFLAVIN CONCENTRATES

NORTHERN REGIONAL RESEARCH LABORATORY 1944-45

NUTRIENT SOLUTION

SUGAR	4.00 PER CENT
UREA	0.20 PER CENT
PROTEIN HYDROLYSATE	0.15 PER CENT

DEMINERALIZATION
TO REMOVE IRON

MINERAL SALTS

SUPPLYING

POTASSIUM MAGNESIUM
PHOSPHATE COPPER

CULTURE

CANDIDA FLARERI

PURE-CULTURE
FERMENTATION

EVAPORATION

DRYING

RIBOFLAVIN CONCENTRATE

40 MILLIGRAMS PER GRAM

STARCH SPONGE

NORTHERN REGIONAL RESEARCH LABORATORY 1944 – 45

5–10% STARCH PASTE
FROZEN AT 0° TO –15°C

THAWED

WATER PRESSED OUT

RESULTING SPONGE DRIED

DRY COARSE SPONGE

DRY FINE SPONGE

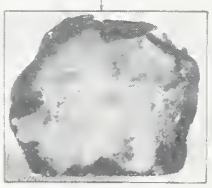
STERILIZED

SPONGE MADE ON GAUZE BACK, ROLLED

STERILIZED

SHREDDED
USED LIKE COCONUT
OR SHREDDED NUTS

GROUND

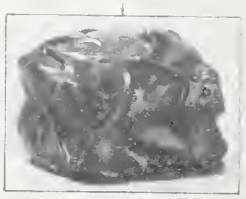


VANILLA CREAM
WITH SHREDS IN
FONDANT CENTER

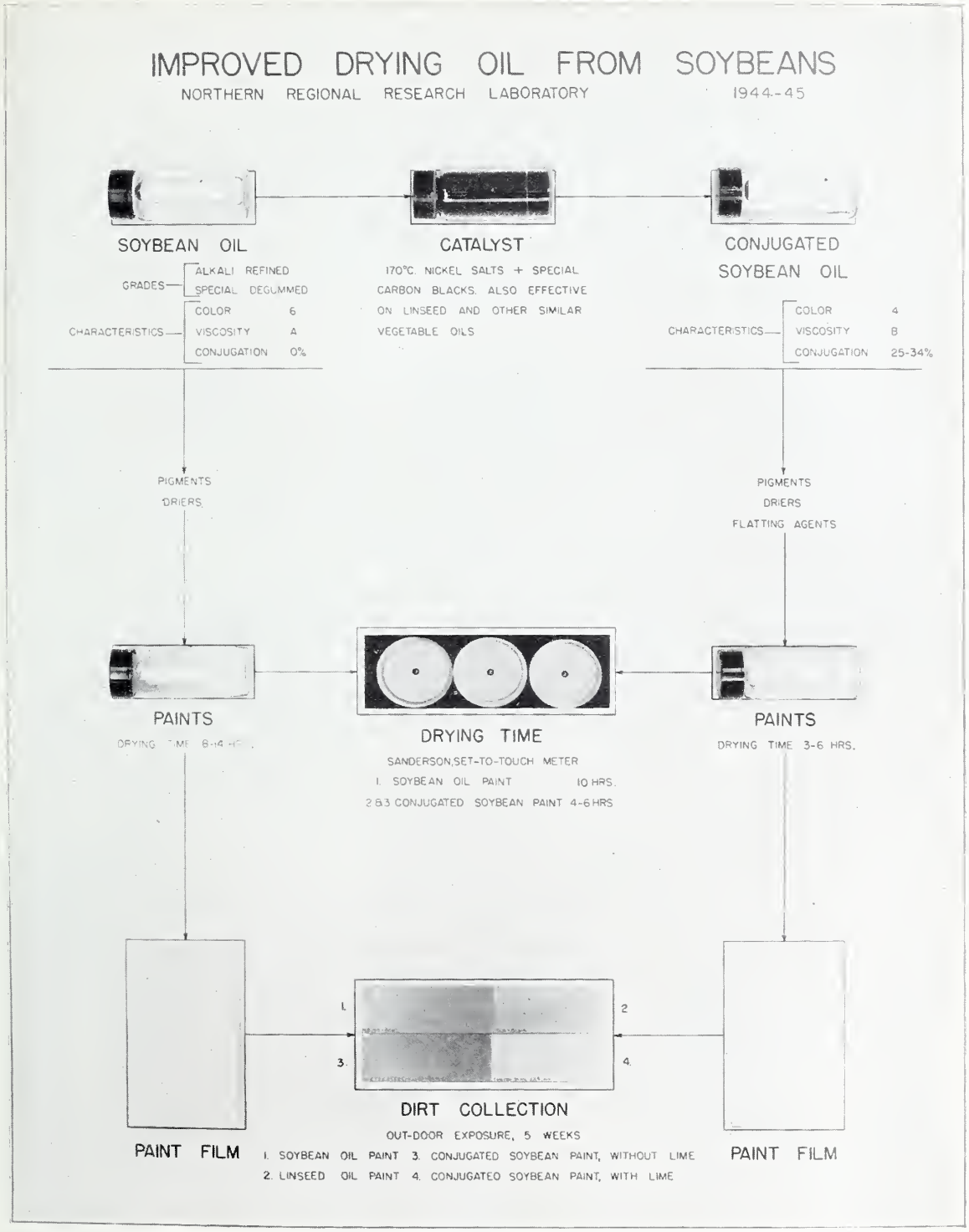
MEDICATED SPONGE
FOR USE AS AN ABSORBABLE
DRESSING IN WOUNDS

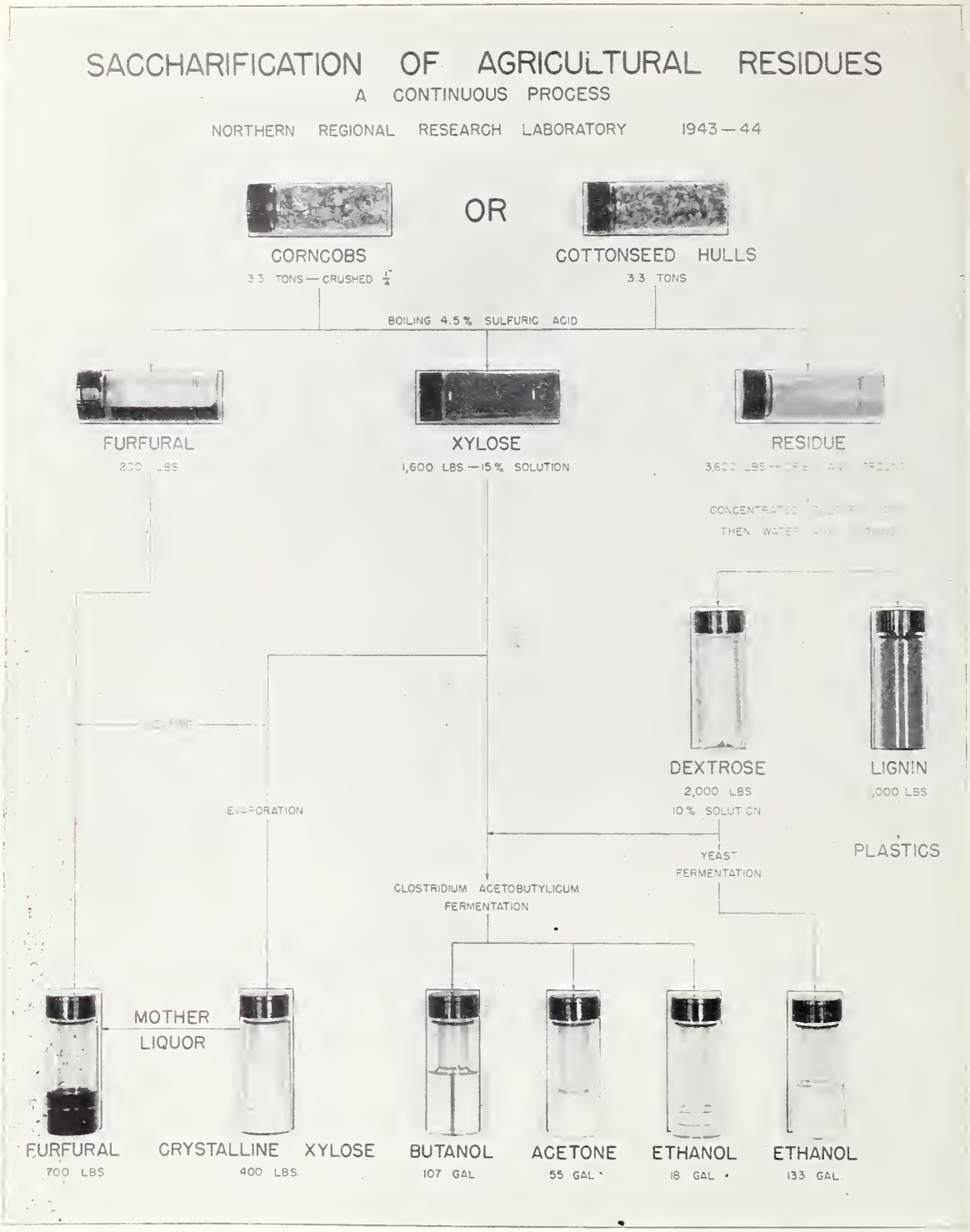
DRESSING
FOR USE ON BURNS
AND SURFACE WOUNDS

TEXTURE
IMPROVER
FOR FOOD PRODUCTS



A CHOCOLATE
WITH CRUNCHY
SPONGE CENTER


IMPROVED DRYING OIL FROM SOYBEANS
NORTHERN REGIONAL RESEARCH LABORATORY
1944-45
SOYBEAN OIL
GRADES
ALKALI REFINED
SPECIAL DEGUMMED
CHARACTERISTICS
COLOR 6
VISCOSITY A
CONJUGATION 0%
CATALYST
170°C. NICKEL SALTS + SPECIAL CARBON BLACKS. ALSO EFFECTIVE ON LINSEED AND OTHER SIMILAR VEGETABLE OILS
CONJUGATED SOYBEAN OIL
CHARACTERISTICS
COLOR 4
VISCOSITY B
CONJUGATION 25-34%
PIGMENTS
DRIERS
PIGMENTS
DRIERS
FLATTING AGENTS
PAINTS
DRYING TIME 8-14 HRS.
DRYING TIME
SANDERSON SET-TO-TOUCH METER
1. SOYBEAN OIL PAINT 10 HRS.
2 & 3 CONJUGATED SOYBEAN PAINT 4-6 HRS
PAINTS
DRYING TIME 3-6 HRS.
PAINT FILM
1
2
3.
4.
DIRT COLLECTION
OUT-DOOR EXPOSURE, 5 WEEKS
PAINT FILM
1. SOYBEAN OIL PAINT 3. CONJUGATED SOYBEAN PAINT, WITHOUT LIME
2. LINSEED OIL PAINT 4. CONJUGATED SOYBEAN PAINT, WITH LIME


SACCHARIFICATION OF AGRICULTURAL RESIDUES
A CONTINUOUS PROCESS
NORTHERN REGIONAL RESEARCH LABORATORY 1943—44
OR
CORNCOBS
3.3 TONS — CRUSHED 1/4"
COTTONSEED HULLS
3.3 TONS
BOILING 4.5% SULFURIC ACID
FURFURAL
200 LBS
XYLOSE
1,600 LBS. — 15% SOLUTION
RESIDUE
3,600 LBS
DEXTROSE
2,000 LBS
10% SOLUTION
LIGNIN
,000 LBS
PLASTICS
EVAPORATION
YEAST
FERMENTATION
CLOSTRIDIUM ACETOBUTYLICUM
FERMENTATION
MOTHER
LIQUOR
FURFURAL
700 LBS
CRYSTALLINE XYLOSE
400 LBS.
BUTANOL
107 GAL
ACETONE
55 GAL
ETHANOL
18 GAL
ETHANOL
133 GAL.

SOUTHERN REGIONAL RESEARCH LABORATORY, New Orleans, La.

SOUTHERN REGIONAL AREA

COMMODITIES STUDIED

Cotton

Sweetpotatoes

Peanuts

SOUTHERN REGIONAL RESEARCH LABORATORY

SWEETPOTATO-STARCH MANUFACTURE

RAW SWEETPOTATOES
100 TONS OR 3,300 BUSHELS

APPROX. AVG. COMPOSITION

STARCH	25%
OTHER SOLIDS	10%
MOISTURE	65%

WASHING

GRINDING

PROCESS WATER 300 TONS

GROUND POTATO

SCREENING

CRUDE STARCH MILK

SETTLING OR CENTRIFUGING

PRESSING

FRUIT WATER CONTAINS 1.7 TONS SUGARS AND 1.1 TONS PROTEIN

CRUDE STARCH

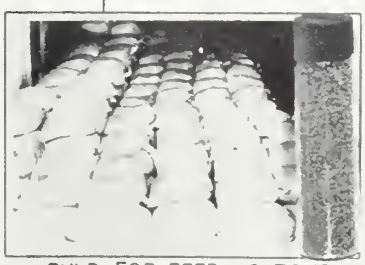
TABLING OR CENTRIFUGING

BLEACHING MODIFYING (OPTIONAL)

CENTRIFUGAL DEWATERING DRYING — BLENDING

WASTE OR BYPRODUCT RECOVERY

DRYING



PROTEIN	3%
DIGESTABLE CARBOHYDRATES	73%
MOISTURE	12%
CRUDE FIBER	11%
ASH	1%

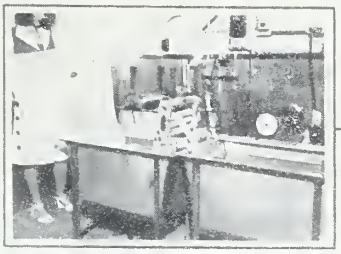
PULP FOR FEED 8 TONS

STARCH 88%
MOISTURE 12%

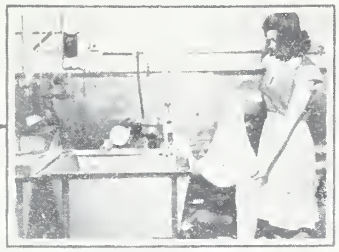
STARCH 20 TONS

NO EP-4

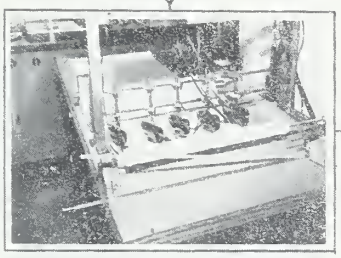
IMPROVED ALL-COTTON BANDAGES



CHEMICAL TREATMENT

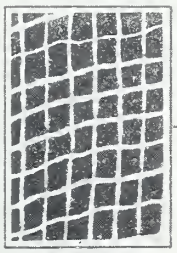


CHEMICALS REMOVED



BANDAGE CUTTING

BANDAGES STERILIZED



ORIGINAL FABRIC

PROPERTIES ADDED

1. SEMI ELASTIC
2. NON SLIP
3. CONFORMS READILY
4. FEATHERWEIGHT

PROCESSED FABRIC

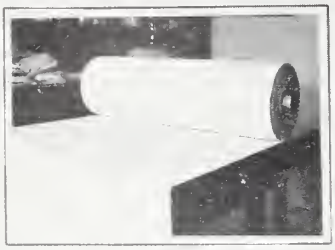
NEW BANDAGE
(LEFT) MAKES A MUCH
BETTER DRESSING

IN USE AS MILD-PRESSURE BANDAGE
U.S. NAVAL HOSPITAL
NEW ORLEANS, LA.

SOUTHERN REGIONAL RESEARCH LABORATORY
NEW ORLEANS, LA.

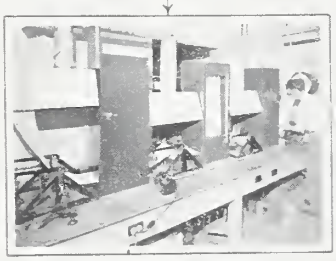
NO. EP-3

ROT-RESISTANT MODIFIED COTTON BY PARTIAL ACETYLATION

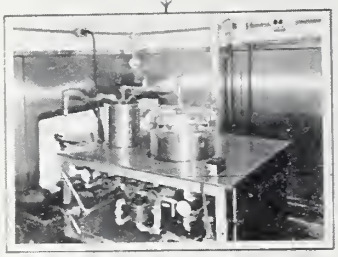


COTTON FABRIC

COTTON THREAD



ACETYLATING FABRIC



ACETYLATING THREAD

MANUFACTURING BAGS

UNTREATED SANDBAGS
6 MONTHS EXPOSURE

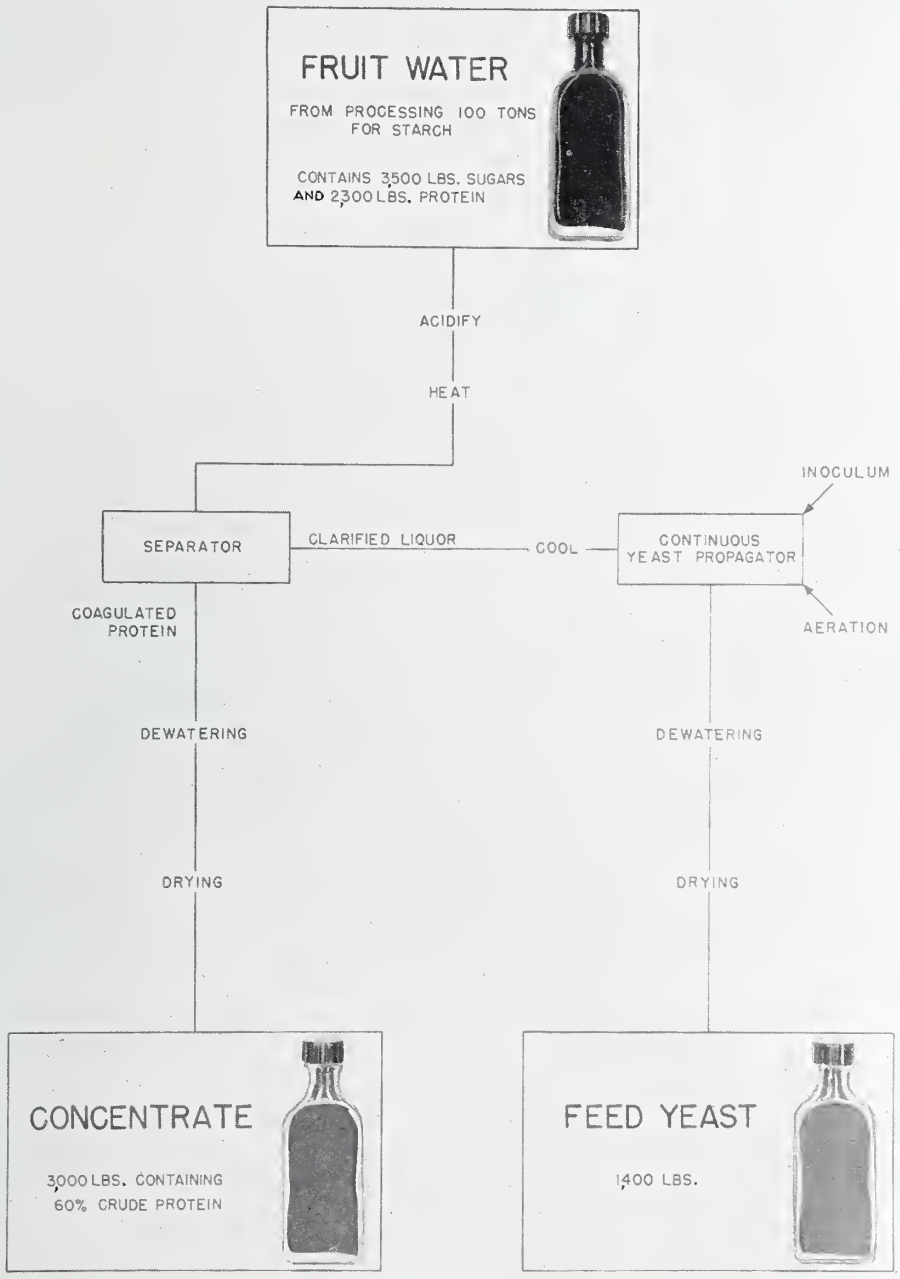
ACETYLATED SANDBAGS
2 YEARS EXPOSURE

SOUTHERN REGIONAL RESEARCH LABORATORY
NEW ORLEANS, LA

NO. EP 10

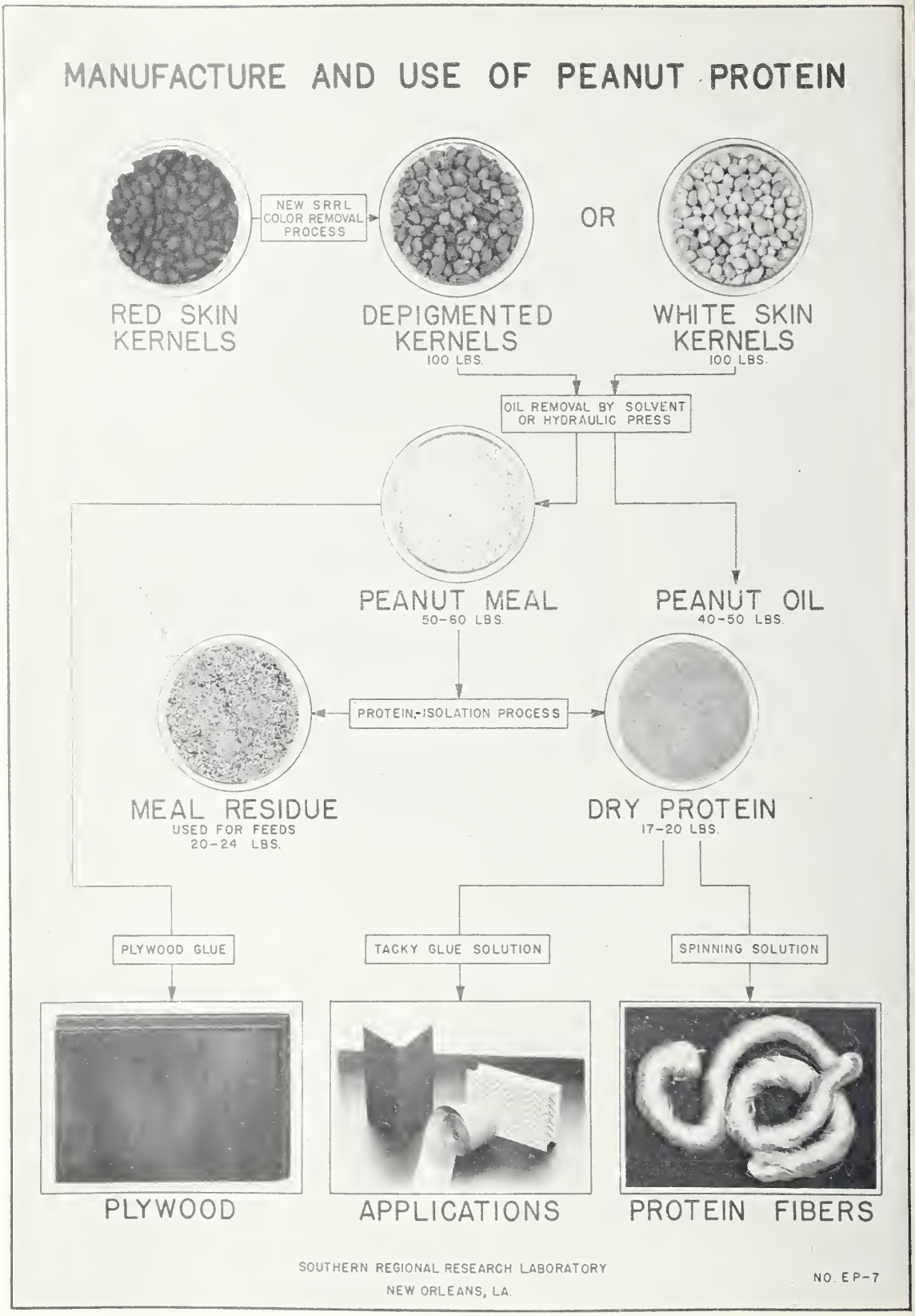
SWEETPOTATO — BYPRODUCT RECOVERY

PROTEIN SUPPLEMENT FOR LIVESTOCK FEED



SOUTHERN REGIONAL RESEARCH LABORATORY
NEW ORLEANS, LA

NO EP5


MANUFACTURE AND USE OF PEANUT PROTEIN
NEW SRRL COLOR REMOVAL PROCESS
OR
RED SKIN KERNELS
DEPIGMENTED KERNELS
100 LBS.
WHITE SKIN KERNELS
100 LBS.
OIL REMOVAL BY SOLVENT OR HYDRAULIC PRESS
PEANUT MEAL
50-60 LBS.
PEANUT OIL
40-50 LBS.
PROTEIN-ISOLATION PROCESS
MEAL RESIDUE
USED FOR FEEDS
20-24 LBS.
DRY PROTEIN
17-20 LBS.
PLYWOOD GLUE
TACKY GLUE SOLUTION
SPINNING SOLUTION
PLYWOOD
APPLICATIONS
PROTEIN FIBERS
SOUTHERN REGIONAL RESEARCH LABORATORY
NEW ORLEANS, LA.
NO. EP-7

SOUTHERN REGIONAL RESEARCH LABORATORY

INDUSTRIAL AND TECHNICAL APPRAISAL

1. Quantities and Qualities of Raw Materials Used.
2. Production and Manufacturing Capacities.
3. Cost Factors:
   - A. Raw Materials.
   - B. Processing.
   - C. Tire Manufacturing.
4. Performance Data:
   - A. Commercial Cotton and Rayon Cords.
   - B. Experimental Cotton Cords.
5. Data on Current Commercial Developments.

COMMERCIAL DEVELOPMENT

1. Selection of Type of Cord.
2. Manufacture of Yarn, Cord and Fabric.
3. Tire Manufacture.
4. Wheel and Road Tests.

CORD DEVELOPMENT AND IMPROVEMENT

1. Use of Selected Varieties of Cotton.
2. Optimum Cord Construction.
3. Improved Processing Methods.
4. Mercerization.
5. "Anti-friction" Treatments.
6. Dual Stretching.
7. Adhesive Treatments.

LABORATORY EVALUATION

1. Fiber Properties:
   - A. Strength.
   - B. Fineness.
   - C. Maturity.
   - D. Length.
   - E. Uniformity of Length.
2. Cord Properties:
   - A. Flex Fatigue.
   - B. Heat Resistance.
   - C. Elasticity and Hysteresis.
   - D. Adhesion.
   - E. Energy of Rupture.
   - F. Impact Strength.

NO EP-14

SOUTHERN REGIONAL RESEARCH LABORATORY

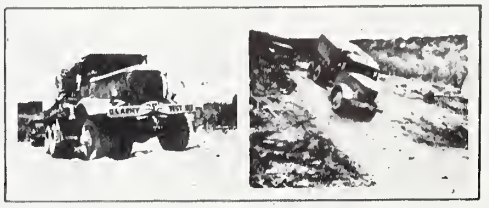
MILITARY SERVICE TEST OF COTTON TIRES

TESTED ON NORMOYLE ORDNANCE TIRE TEST FLEET, SAN ANTONIO, TEXAS

THE COURSE

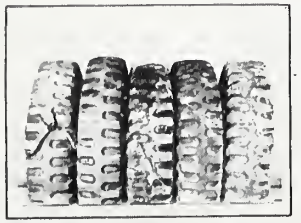
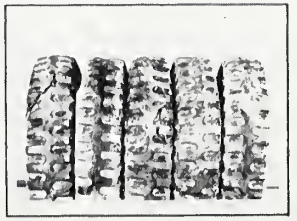
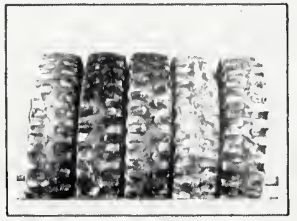
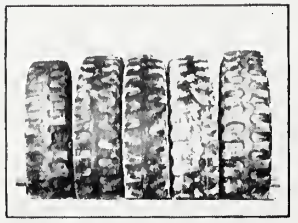
70% HARD SURFACE

15% GRAVEL



15% CROSS COUNTRY

THE RESULTS: ON 7.50-20 90% SYNTHETIC TIRES WITH SELECTED COTTONS.— TEST N-285

	CONTROL	STONEVILLE	SxP	WILDS
				
FAILURES DUE TO FABRIC BREAKS	4	4	3	1
AVERAGE MILEAGE	4,700	6,500	9,400	11,900
PERCENTAGE BASED ON CONTROL	100%	138	200	253

CONCLUSION: SUPERIOR PERFORMANCE IN COTTON TRUCK TIRES FOR COMBAT AND FIELD SERVICE MAY BE OBTAINED BY SELECTION OF COTTONS WITH APPROPRIATE CHARACTERISTICS

NO. EP-12

SOUTHERN REGIONAL RESEARCH LABORATORY

HEAT BLOW-OUT TEST OF COTTON TIRES

ORDNANCE DESERT PROVING GROUND EL CENTRO, CALIFORNIA.

TEST COURSE AND SPEED

ASPHALT AND CONCRETE HIGHWAYS	85%
GRAVEL ROADS	15%
SPEED	40 M.P.H

TIRE LOADS

FRONT TIRES:	OVERLOAD THROUGHOUT TEST	20%
CENTER AND REAR TIRES:	OVERLOAD UP TO 10,000 MILES	20%
	OVERLOAD 10,000 TO 15,000 MILES	40%

RESULTS: FINAL MILEAGES AND TYPES OF FAILURES ON 7.50-20 MILITARY TRUCK TIRES-TEST D-285

CONTROL			STONEVILLE			SxP			WILDS		
FRONT	12,292	HEAT BLOW-OUT	FRONT	15,000	NO FAILURE	FRONT	12,355	NO FAILURE	FRONT	15,000	NO FAILURE
CENTER	12,974	HEAT BLOW-OUT	CENTER	13,085	HEAT BLOW-OUT	FRONT	9,471	DEFECTIVE	CENTER	10,134	NO FAILURE
REAR	12,405	NO FAILURE	CENTER	7,506	NO FAILURE	CENTER	15,000	TREAD SEP.	CENTER	10,098	TREAD SEP.
REAR	2,436	DAMAGED	REAR	12,587	HEAT BLOW-OUT	REAR	5,272	NO FAILURE	REAR	10,134	NO FAILURE
REAR	214	DEFECTIVE	ONLY FOUR STONEVILLE TIRES TESTED			REAR	13,552	DAMAGED	REAR	10,098	TREAD SEP.

REMARKS: NO FABRIC FAILURES OCCURRED IN ANY OF THE WILDS OR SxP TIRES WHILE 2 EACH OCCURRED IN THE CONTROL AND STONEVILLE TIRES. PLANNED LENGTH OF TEST WAS 15,000 MILES, BUT TEST COURSE WAS CLOSED BEFORE SOME REPLACEMENT TIRES HAD CHANCE TO FAIL OR RUN TO 15,000 MILES. AS A CONSEQUENCE VALID COMPARISON CANNOT BE MADE ON AVERAGE MILEAGE BASIS

CONCLUSION "THE ORDNANCE DESERT TEST RESULTS ABOVE ARE VERY GOOD FOR ALL TIRES RANKING WITH THE BEST BEING TESTED BY OTHER COMPANIES AND BETTER THAN MANY BEING TESTED"

NO. EP-13

SOUTHERN REGIONAL RESEARCH LABORATORY

HIGHWAY-PERFORMANCE TEST OF COTTON TIRES

TESTED ON GOVERNMENT TIRE TEST FLEET, SAN ANTONIO, TEXAS

7.00-20 TRUCK TIRES - S4

AVERAGE TIRE MILEAGES TO FAILURE

TEST 207
SPECIFICATIONS:
REAR POSITION
3000 LB. LOAD
100% PAVEMENT
45 MILES PER HOUR

	TEST STARTED 8-9-44	TEST STARTED 8-19-44
CONTROL COTTON	4,200	7,400
WILDS COTTON	23,000	13,000
RAYON	26,000	INVALID TEST*

*DUE TO INJURIES AND MANUFACTURING DEFECTS

TYPICAL FAILURES

CONCLUSIONS: WILDS SUPERIOR TO REGULAR COMMERCIAL COTTONS ON HIGHWAY TRUCKING SERVICE

6.00-16 PASSENGER TIRES - S3

TEST K
SPECIFICATIONS:
FRONT AND REAR
950 LB. LOAD
100% PAVEMENT
60 MILES PER HOUR

CONTROL COTTON	48,000	68,000
WILDS COTTON	48,000	68,000

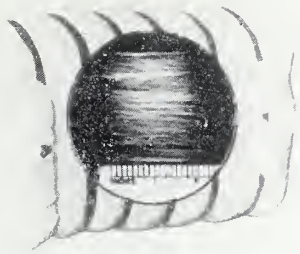
TIRES AT END OF TEST

ALL RECAPPED ONCE. IN SATISFACTORY SERVICE WHEN TEST WAS DISCONTINUED
CONCLUSIONS: COTTON FABRIC ENTIRELY SATISFACTORY FOR PASSENGER TIRES

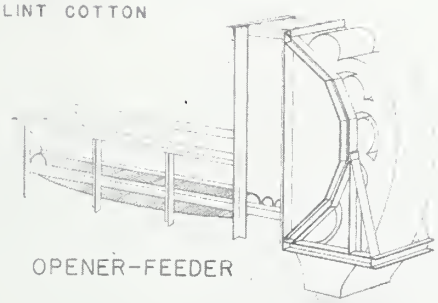
NO. EP-11

CUT LINT COTTON

A SUBSTITUTE FOR LINTERS



BALED LINT COTTON

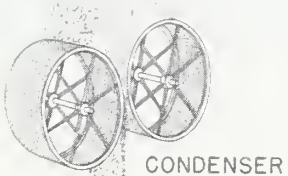


OPENER-FEEDER

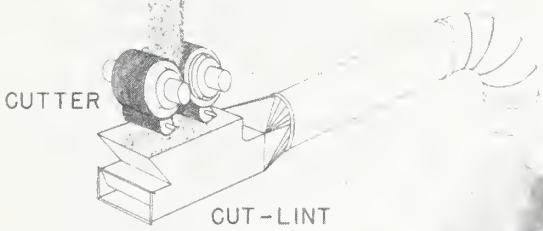
THE CUT COTTON IS PURIFIED AND THE CELLULOSE OBTAINED IS USED AS A SUBSTITUTE FOR LINTERS IN THE MANUFACTURE OF SMOKELESS POWDER, RAYON, PLASTICS, ETC.

THE UNITS SHOWN WERE DESIGNED BY THE S.R.R.L. THE OPENER-FEEDER AND THE CUTTER UNITS ARE COVERED BY PUBLIC-SERVICE PATENTS NOS. 2,365,793 AND 2,370,129 RESPECTIVELY.

COTTON FROM BALES IS FED BY THE OPENER-FEEDER LATTICE APRON INTO A MULTIPLICITY OF ROTATING GIN SAWS. THE SAWS REDUCE THE COTTON TO TINY TUFTS WHICH ARE CONVEYED BY AIR TO THE CONDENSER. THE CONDENSER REMOVES THE AIR, ARRANGES THE TUFTS INTO AN ENDLESS SHEET, AND FEEDS THIS SHEET INTO THE CUTTER BLADES. A CONTINUOUS SHEARING ACTION THEN CUTS THE FIBERS TO A LENGTH COMPARABLE TO THAT OF LINTERS.



CONDENSER



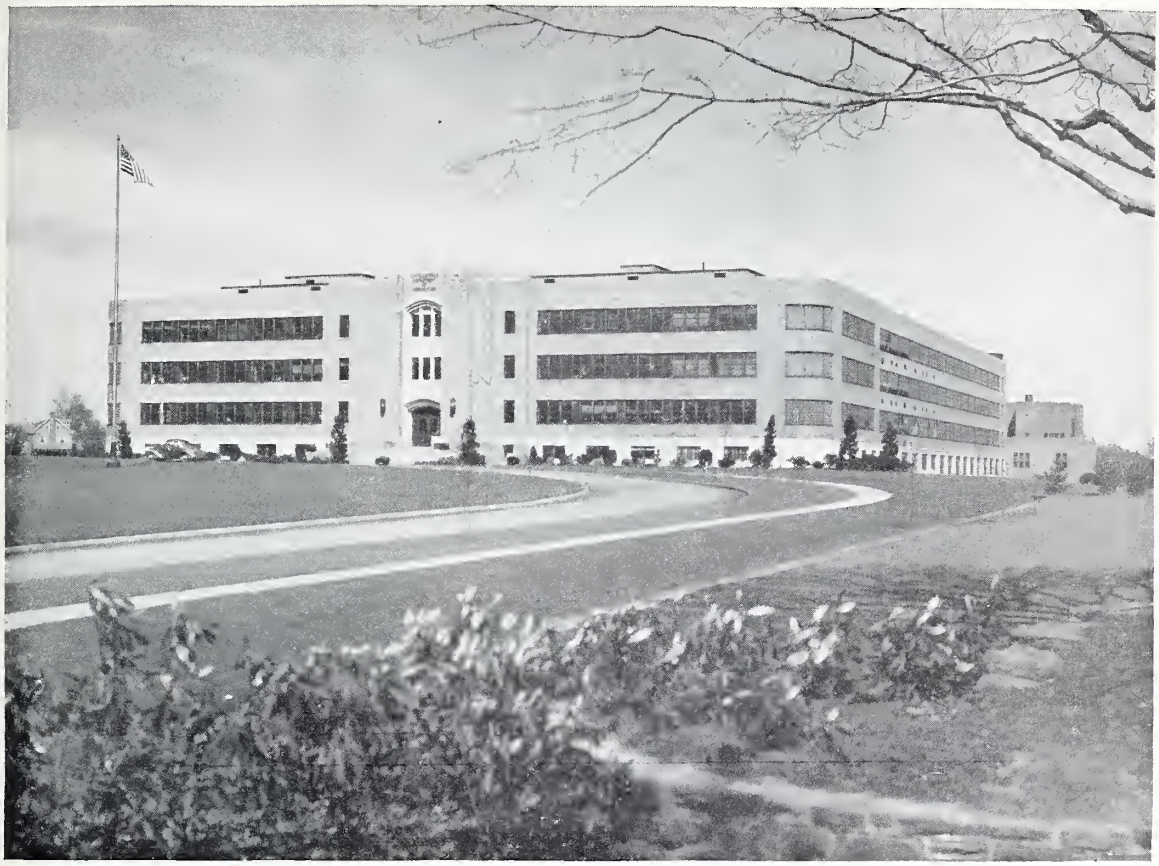
CUTTER

CUT-LINT COLLECTOR

LINTERS' LENGTH LINT COTTON

SOUTHERN REGIONAL RESEARCH LABORATORY
NEW ORLEANS, LA.

NO. EP-2

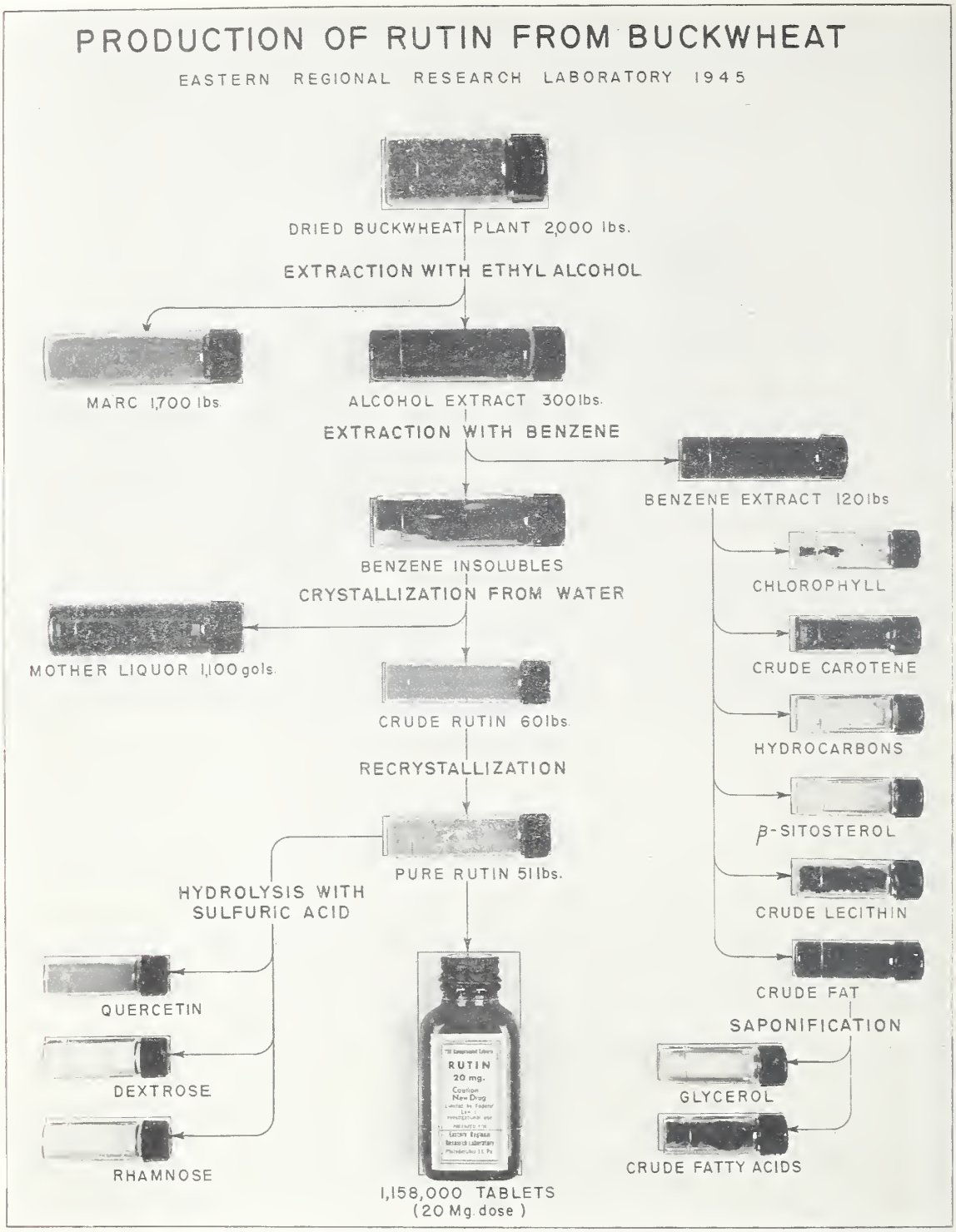


EASTERN REGIONAL RESEARCH LABORATORY, Philadelphia, Pa.

EASTERN
REGIONAL
AREA

COMMODITIES STUDIED

- Tobacco
- Apples
- White potatoes
- Milk products
- Vegetables
- Animal fats and oils
- Tanning materials, hides and skins


PRODUCTION OF RUTIN FROM BUCKWHEAT
EASTERN REGIONAL RESEARCH LABORATORY 1945
DRIED BUCKWHEAT PLANT 2,000 lbs.
EXTRACTION WITH ETHYL ALCOHOL
MARC 1,700 lbs.
ALCOHOL EXTRACT 300lbs.
EXTRACTION WITH BENZENE
BENZENE EXTRACT 120lbs
BENZENE INSOLUBLES
CRYSTALLIZATION FROM WATER
CHLOROPHYLL
CRUDE CAROTENE
HYDROCARBONS
β-SITOSTEROL
CRUDE LECITHIN
CRUDE FAT
SAPONIFICATION
MOTHER LIQUOR 1,100 gals.
CRUDE RUTIN 60lbs.
RECRYSTALLIZATION
PURE RUTIN 51lbs.
HYDROLYSIS WITH SULFURIC ACID
QUERCETIN
DEXTROSE
RHAMNOSE
RUTIN
20 mg.
Caution
New Drug
1,158,000 TABLETS
(20 Mg. dose)
GLYCEROL
CRUDE FATTY ACIDS

IMPROVED EMULSIFIERS
FOR USE IN THE MANUFACTURE OF GR-S SYNTHETIC RUBBER

EASTERN REGIONAL RESEARCH LABORATORY 1945

FORMER PROCESS

Market for 80,000,000 lbs. of tallow annually.
Large part of it was scarce edible tallow
ERRATIC RATES OF POLYMERIZATION

INEDIBLE TALLOW EDIBLE TALLOW

SAPONIFICATION

GLYCEROL SOAP

Suitability of soap estimated by iodine, thiocyanogen, and polybromide numbers.

NITROGLYCERINE
PHARMACEUTICALS
SYNTHETIC RESINS

EMULSION POLYMERIZATION
IN MANUFACTURE OF GR-S
18-24 HOURS REACTION TIME

GR-S SYNTHETIC RUBBER
CONTAINING 5% FATTY ACIDS
Yield: 800,000 tons annually.

IMPROVED PROCESS

Market for 100,000,000 lbs. of tallow and grease annually. No edible tallow used
CONSTANT RATE OF POLYMERIZATION

INEDIBLE TALLOW GREASE

SELECTIVE HYDROGENATION

PARTIALLY HYDROGENATED FAT

POLY-UNSATURATED FATTY ACID CONTENT

3 to 7% less than 0.7%

SAPONIFICATION SAPONIFICATION

SOAP GLYCEROL

Suitability of soap rigidly controlled by spectrophotometric analysis

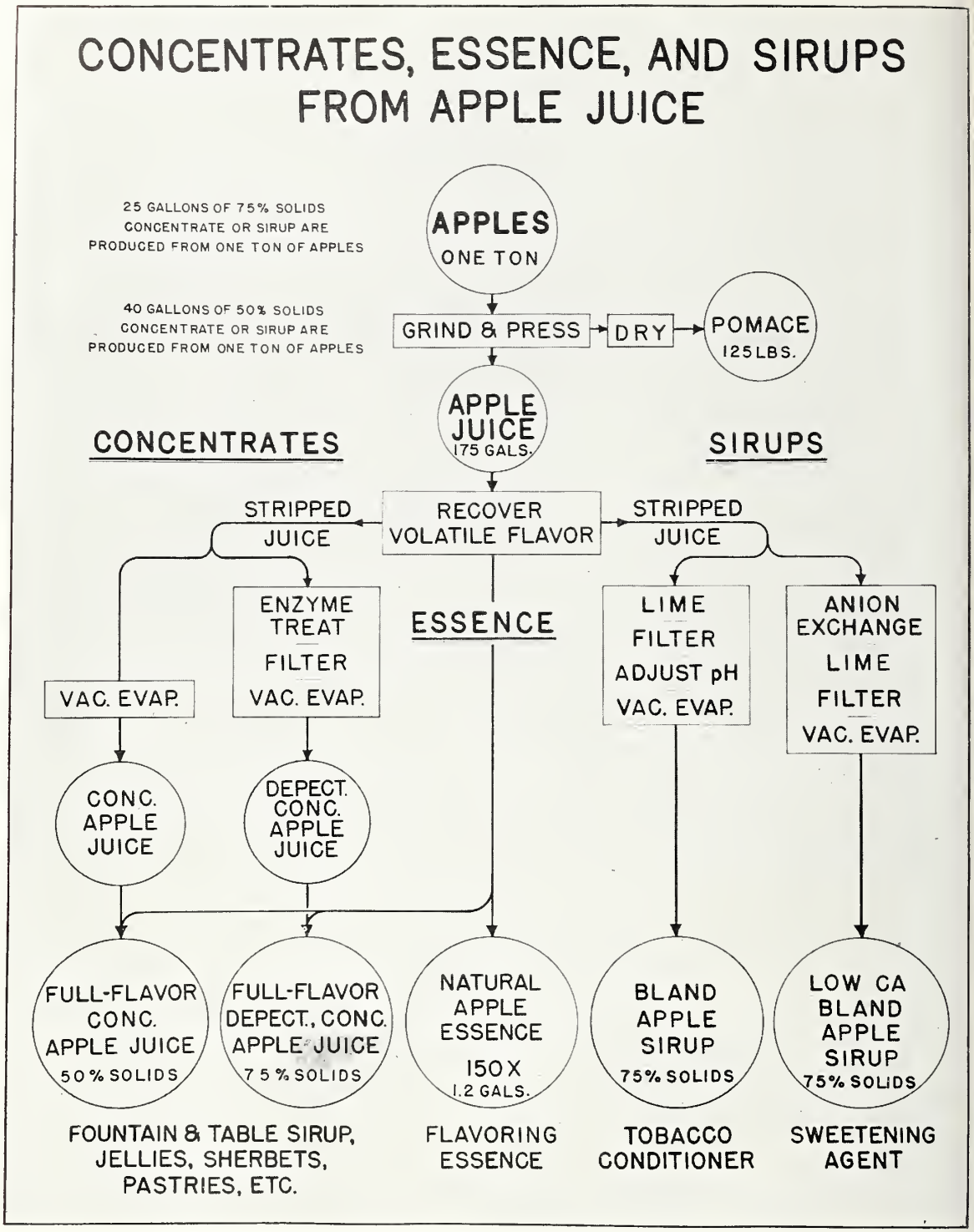
NITROGLYCERINE
PHARMACEUTICALS
SYNTHETIC RESINS

EMULSION POLYMERIZATION
IN MANUFACTURE OF GR-S
13 HOURS REACTION TIME *

GR-S SYNTHETIC RUBBER
CONTAINING 5% FATTY ACIDS
Yield: 1,000,000 tons annually,
with same plant facilities.

* *A standard polymerization time of 13 hours, instead of a variable time of 18 to 24 hours, enabled plants to set up a definite production schedule for the first time, permitting a large increase in output from same plant facilities.*

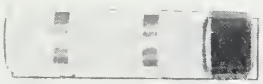
CONCENTRATES, ESSENCE, AND SIRUPS FROM APPLE JUICE



CASEIN BRISTLE

EASTERN REGIONAL RESEARCH LABORATORY 1942-45.

PROCESS



COMMERCIAL CASEIN, 100 PARTS
WATER, 136 PARTS

EXTRUDER
HEATED TO 100°C.

UNHARDENED CASEIN FIBER

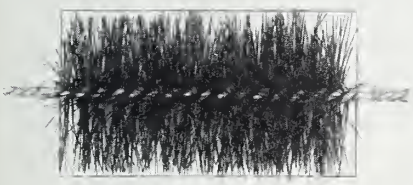
AQUEOUS QUINONE SOLUTION TREATMENT.

10 PARTS QUINONE COMBINE WITH FIBER

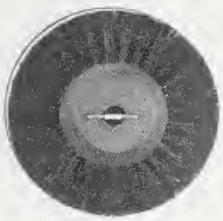
FIBER STRETCHED 100%
AND DRIED

CASEIN BRISTLE, 110 PARTS.

USES



TWISTED-IN-WIRE BRUSH

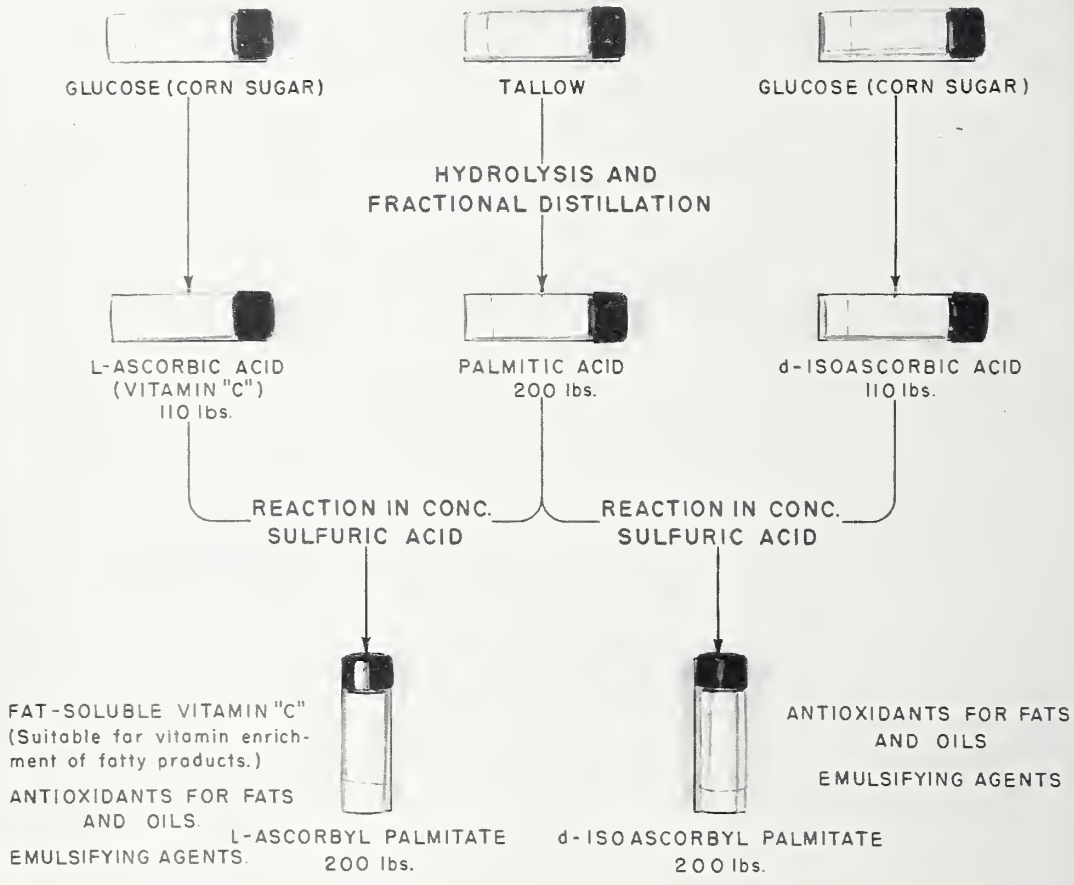


JEWELER'S POLISHING BRUSH

PAINT BRUSH

FAT-SOLUBLE ESTERS OF ASCORBIC AND ISOASCORBIC ACIDS

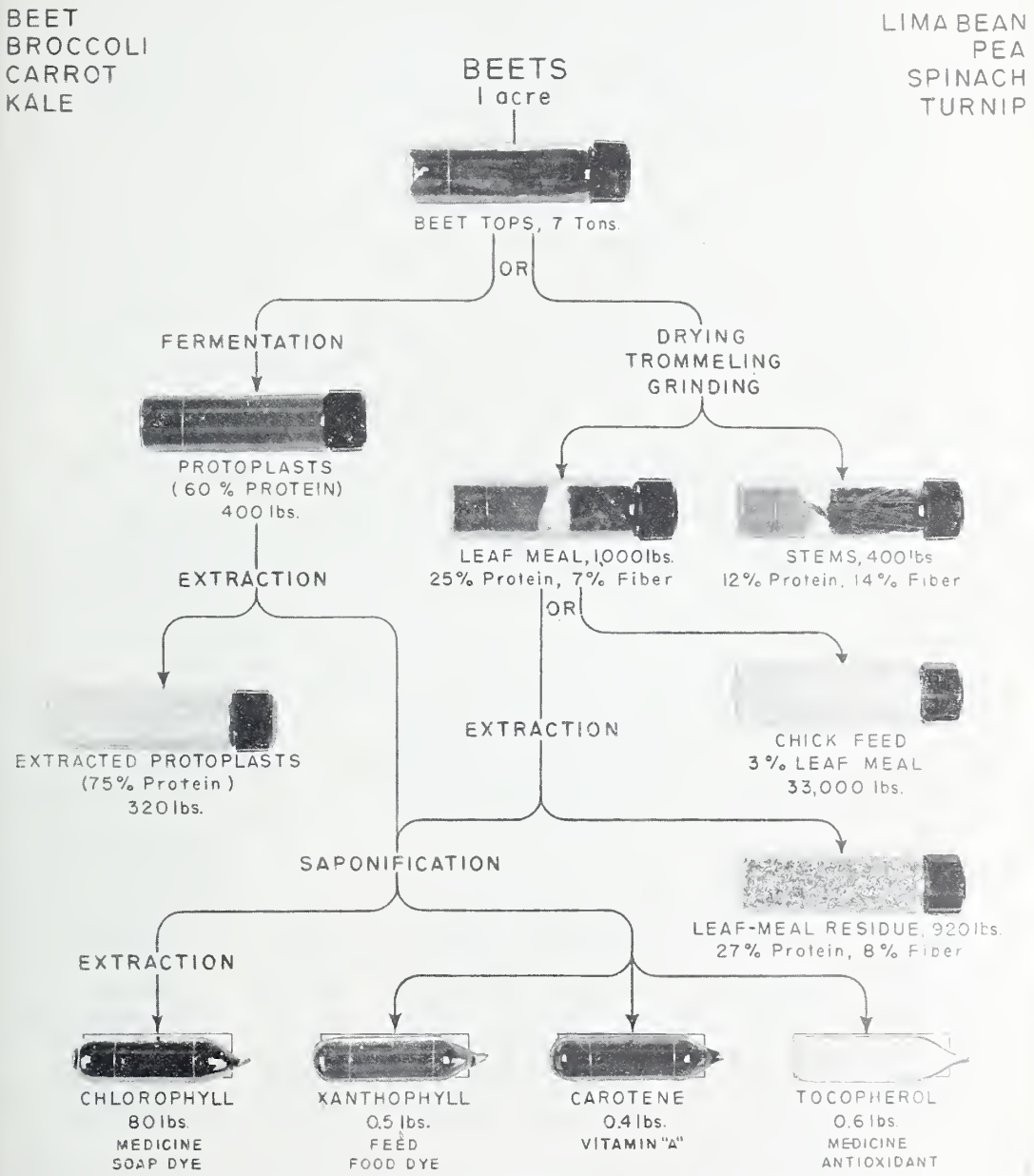
EASTERN REGIONAL RESEARCH LABORATORY 1941-44

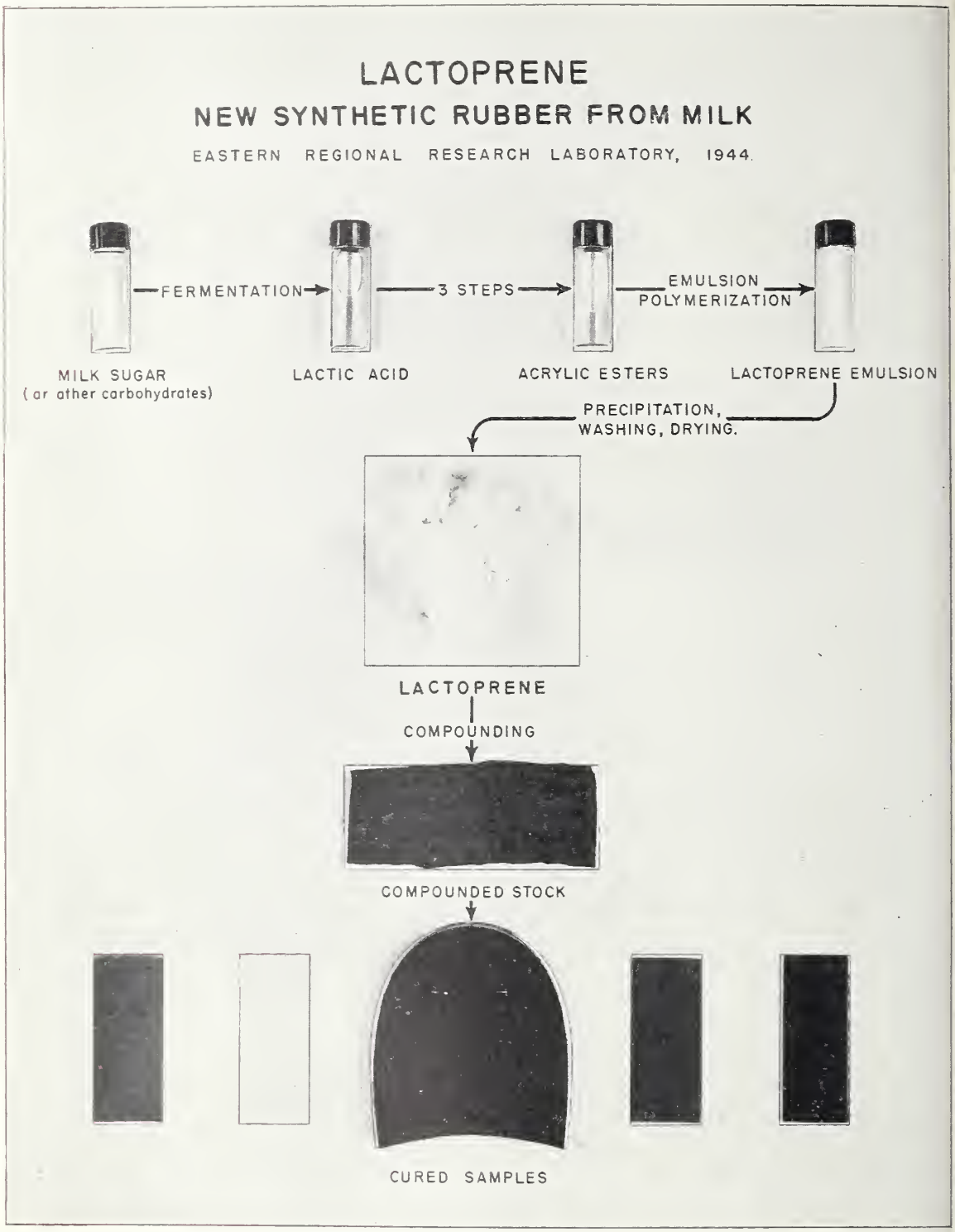


By employing other fatty acids, such as myristic and stearic acids, other equally valuable products are obtained.

LEAF WASTES OF THE VEGETABLE INDUSTRY

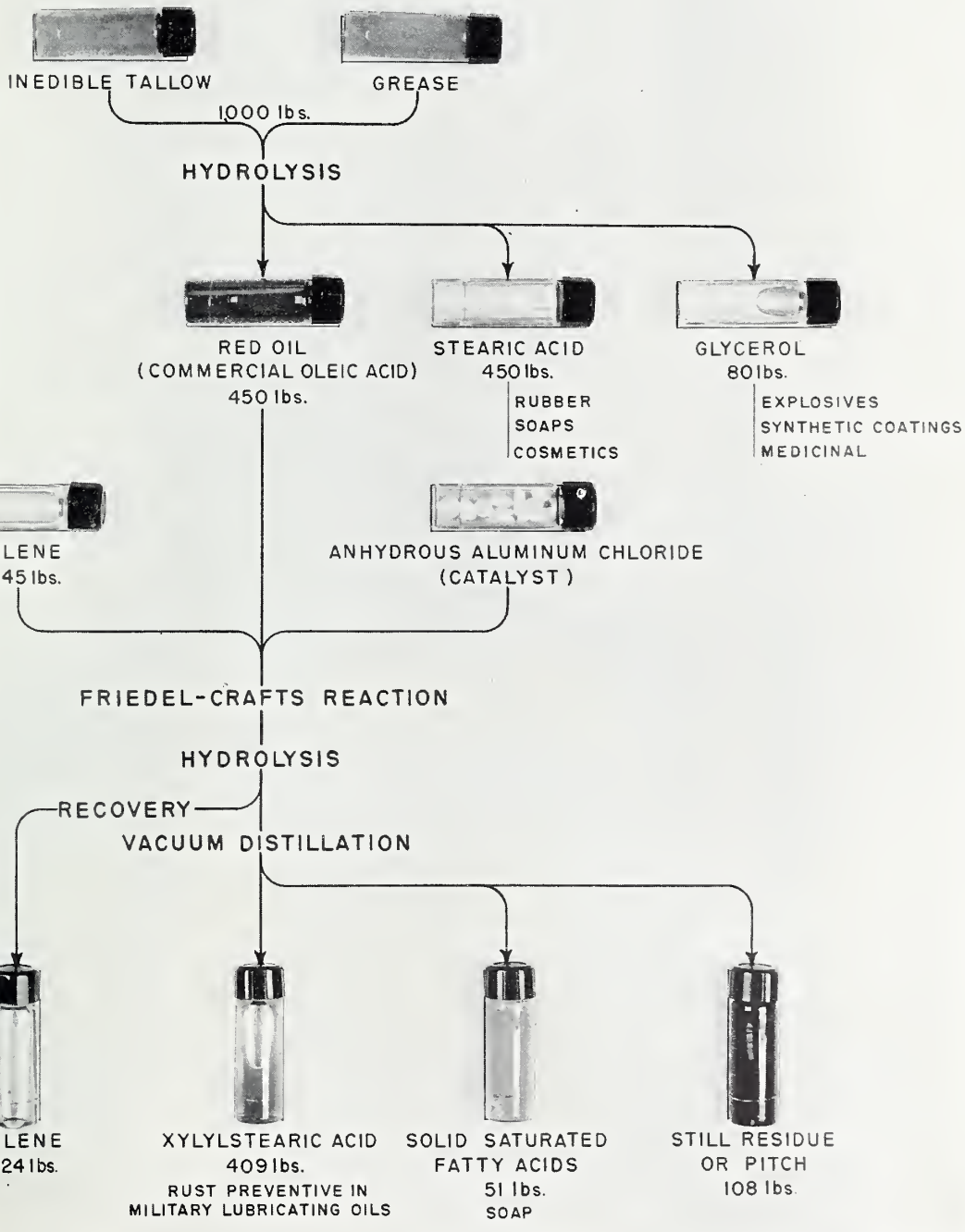
EASTERN REGIONAL RESEARCH LABORATORY 1941-45




LACTOPRENE
NEW SYNTHETIC RUBBER FROM MILK
EASTERN REGIONAL RESEARCH LABORATORY, 1944
FERMENTATION
3 STEPS
EMULSION POLYMERIZATION
MILK SUGAR
(or other carbohydrates)
LACTIC ACID
ACRYLIC ESTERS
LACTOPRENE EMULSION
PRECIPITATION, WASHING, DRYING.
LACTOPRENE
COMPOUNDING
COMPOUNDED STOCK
CURED SAMPLES

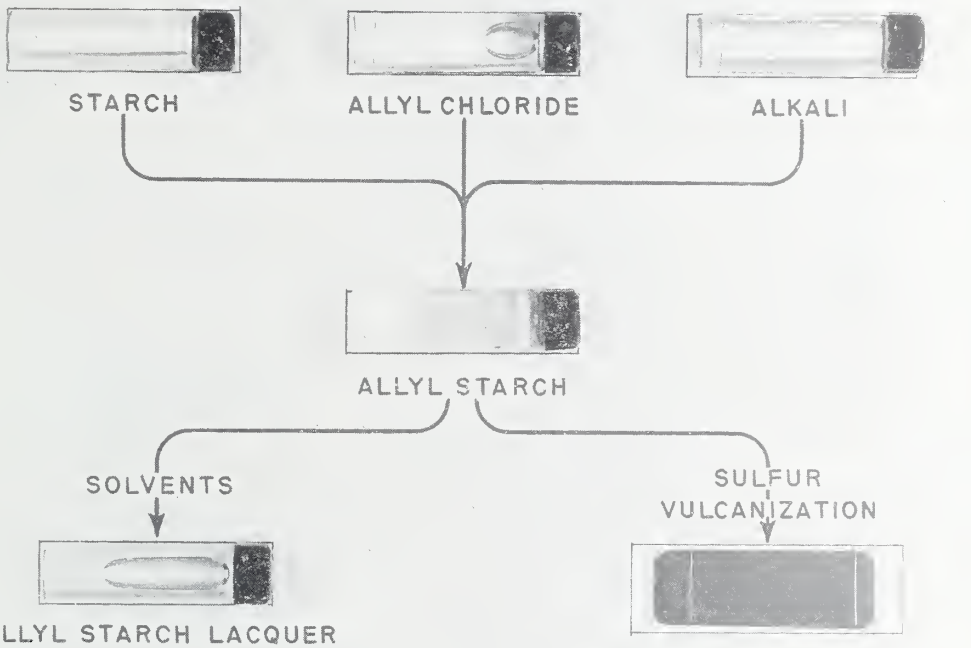
ARYLSTEARIC ACIDS

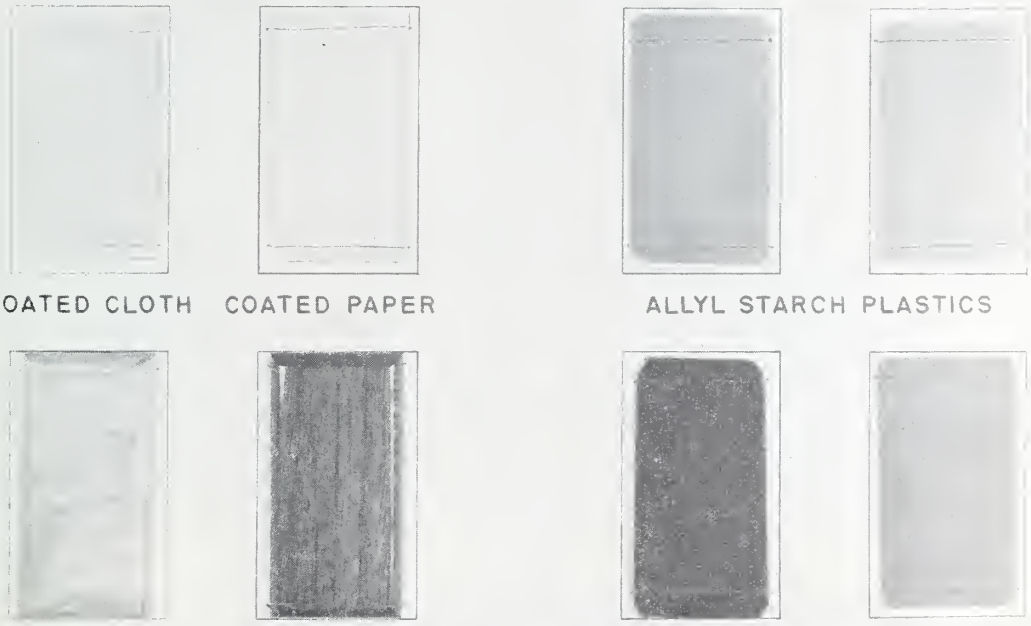
EASTERN REGIONAL RESEARCH LABORATORY 1945.



ALLYL STARCH

EASTERN REGIONAL RESEARCH LABORATORY 1943-45



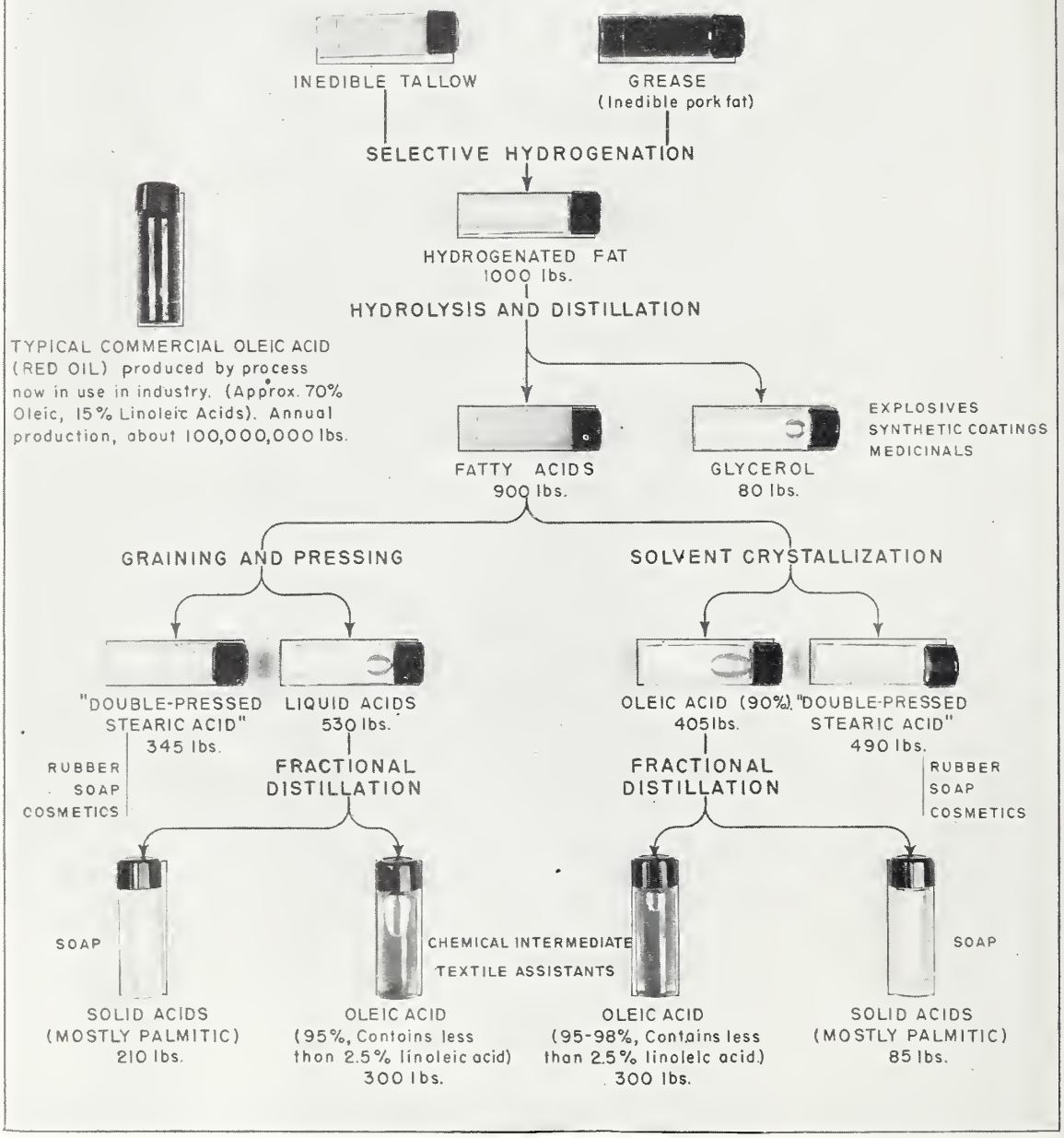


COATED CLOTH COATED PAPER ALLYL STARCH PLASTICS

COATED WOOD LAMINATED ALLYL STARCH PLASTICS

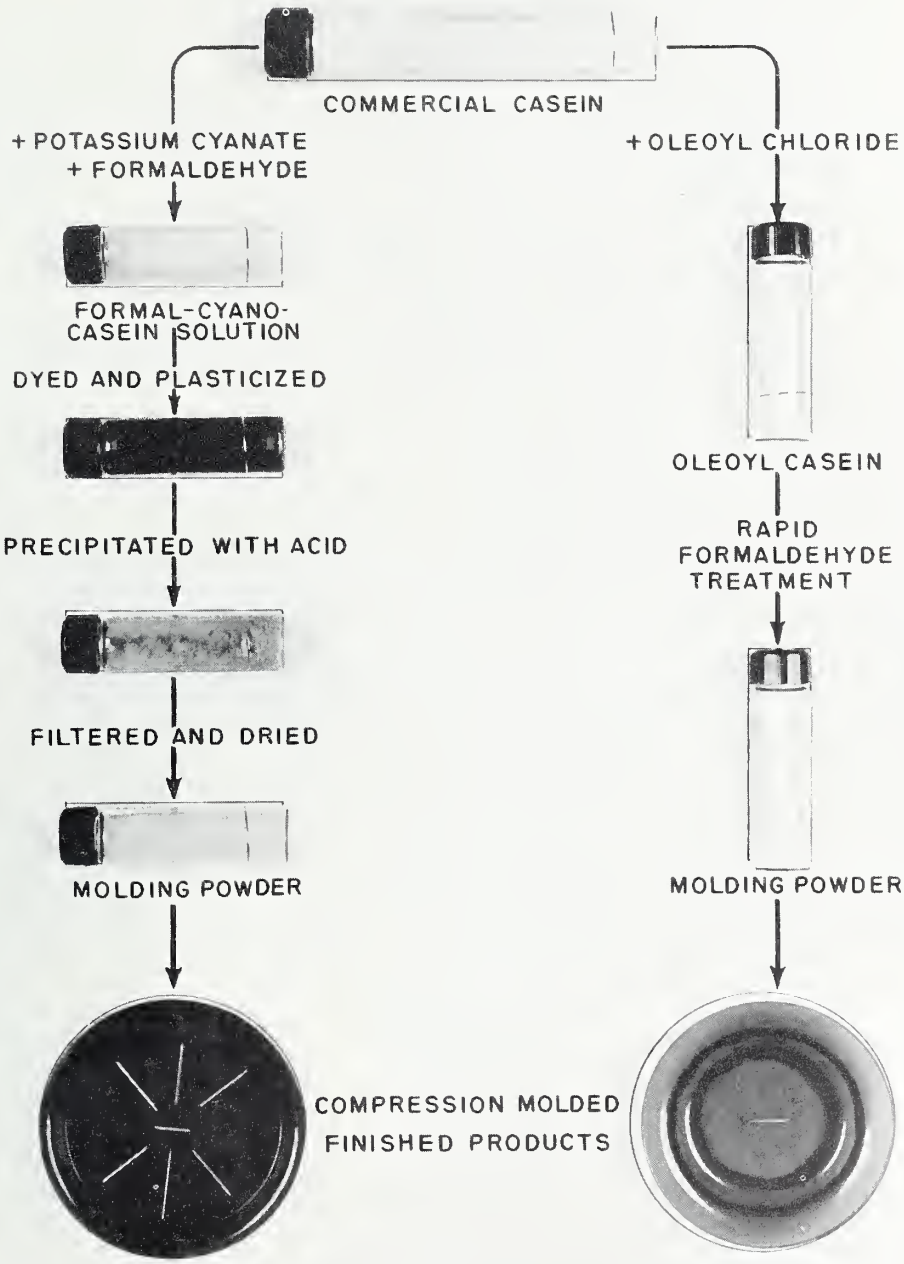
IMPROVED PROCESS FOR OLEIC ACID PRODUCTION

EASTERN REGIONAL RESEARCH LABORATORY 1944.

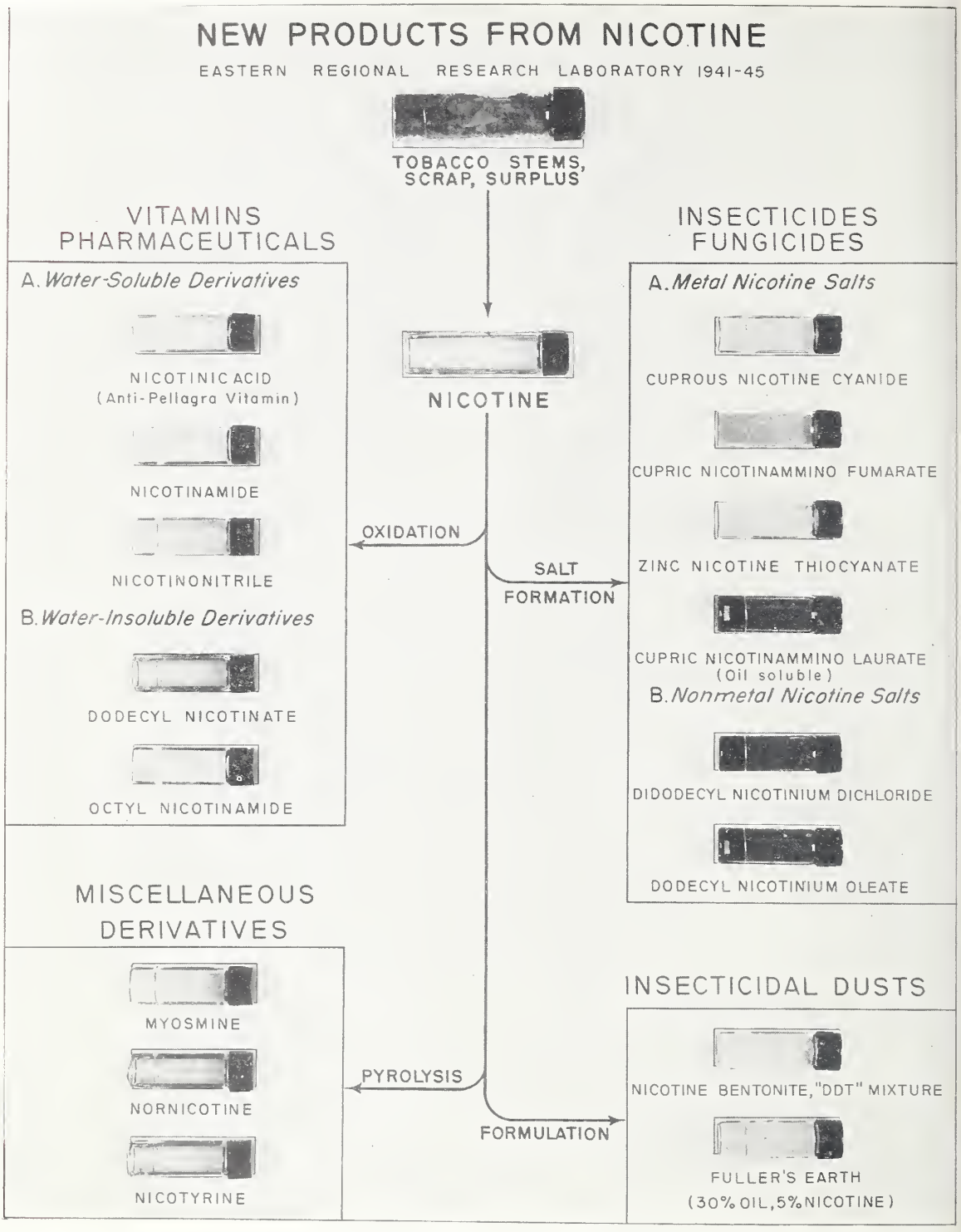


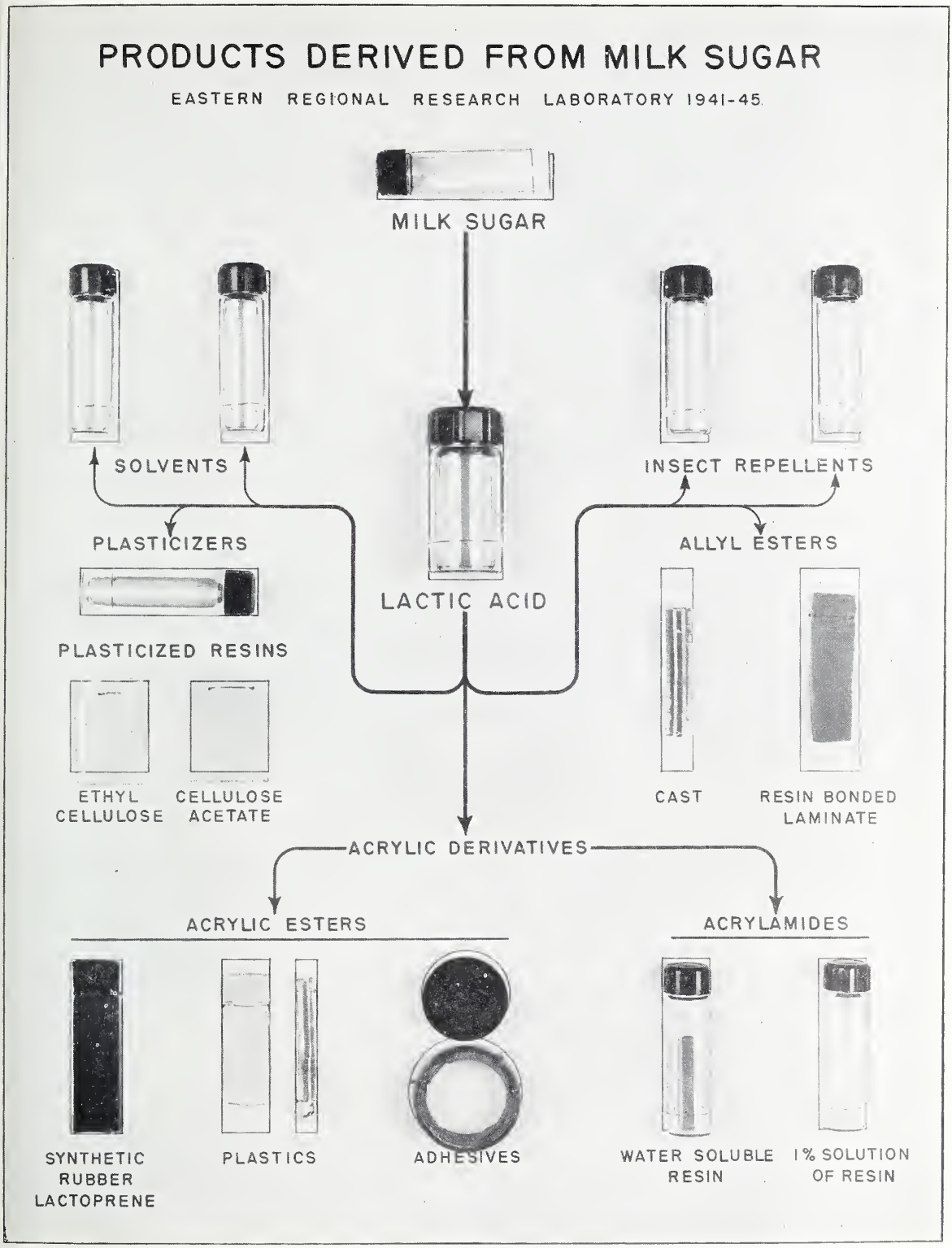
DIRECT MOLDING OF MODIFIED-CASEIN PLASTICS

EASTERN REGIONAL RESEARCH LABORATORY 1942-45



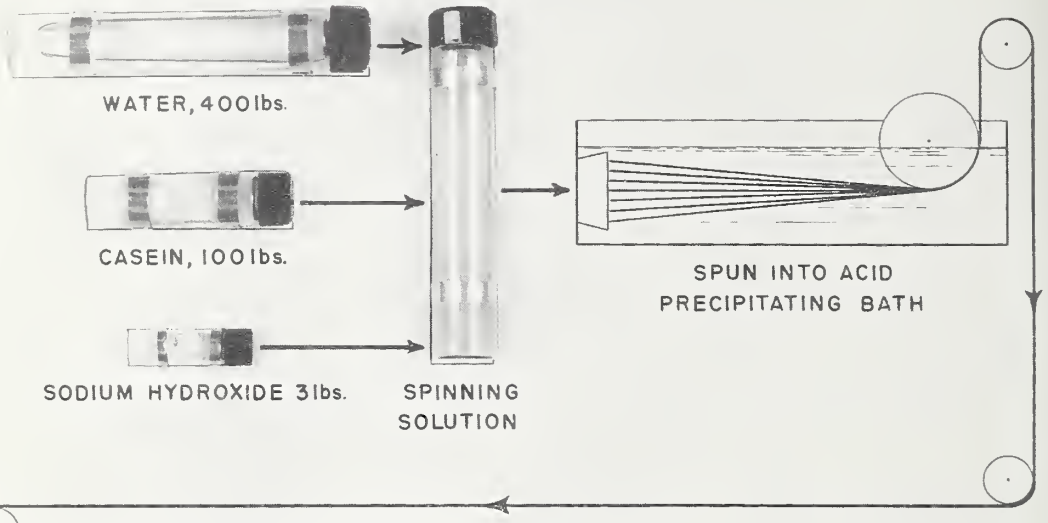
Established commercial manufacture of present-day casein plastics involves extrusion, shaping, hardening, conditioning and dip polishing, requiring up to 2 or 3 weeks.

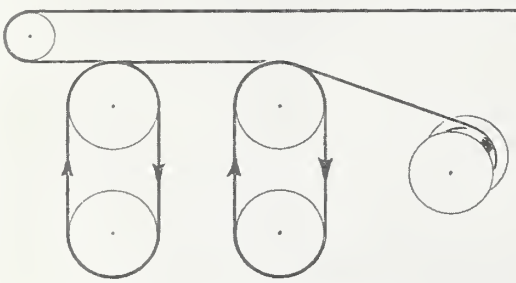

NEW PRODUCTS FROM NICOTINE
EASTERN REGIONAL RESEARCH LABORATORY 1941-45
TOBACCO STEMS, SCRAP, SURPLUS
NICOTINE
VITAMINS PHARMACEUTICALS
A. Water-Soluble Derivatives
NICOTINIC ACID (Anti-Pellagra Vitamin)
NICOTINAMIDE
NICOTINONITRILE
B. Water-Insoluble Derivatives
DODECYL NICOTINATE
OCTYL NICOTINAMIDE
OXIDATION
SALT FORMATION
INSECTICIDES FUNGICIDES
A. Metal Nicotine Salts
CUPROUS NICOTINE CYANIDE
CUPRIC NICOTINAMMINO FUMARATE
ZINC NICOTINE THIOCYANATE
CUPRIC NICOTINAMMINO LAURATE (Oil soluble)
B. Nonmetal Nicotine Salts
DIDODECYL NICOTINIUM DICHLORIDE
DODECYL NICOTINIUM OLEATE
MISCELLANEOUS DERIVATIVES
MYOSMINE
NORNICOTINE
NICOTYRINE
PYROLYSIS
FORMULATION
INSECTICIDAL DUSTS
NICOTINE BENTONITE, "DDT" MIXTURE
FULLER'S EARTH (30% OIL, 5% NICOTINE)


PRODUCTS DERIVED FROM MILK SUGAR
EASTERN REGIONAL RESEARCH LABORATORY 1941-45
MILK SUGAR
SOLVENTS
INSECT REPELLENTS
PLASTICIZERS
ALLYL ESTERS
LACTIC ACID
PLASTICIZED RESINS
ETHYL CELLULOSE
CELLULOSE ACETATE
CAST
RESIN BONDED LAMINATE
ACRYLIC DERIVATIVES
ACRYLIC ESTERS
ACRYLAMIDES
SYNTHETIC RUBBER LACTOPRENE
PLASTICS
ADHESIVES
WATER SOLUBLE RESIN
1% SOLUTION OF RESIN

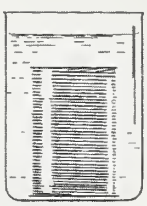
CASEIN TEXTILE FIBER

EASTERN REGIONAL RESEARCH LABORATORY 1941-45





STRETCHED ON WHEELS REVOLVING AT DIFFERENT SPEEDS.



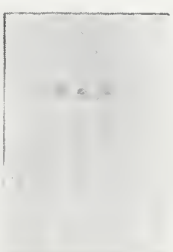
HARDENED IN FORMALDEHYDE

FINISHED

1. WASHED AND DRIED
2. CUT TO STAPLE LENGTH 1½" to 2"
3. CARDED AND BLENDED

100 POUNDS OF FIBER

CUT STAPLE

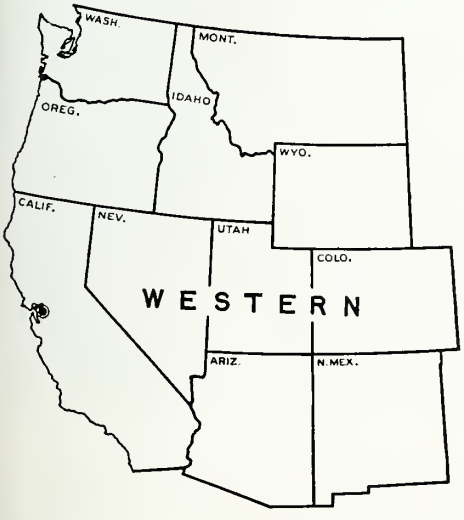


YARN

WOVEN AND DYED

WESTERN REGIONAL RESEARCH LABORATORY, Albany, Calif.

WESTERN REGIONAL AREA



COMMODITIES STUDIED

Fruits

Vegetables

Potatoes

Wheat

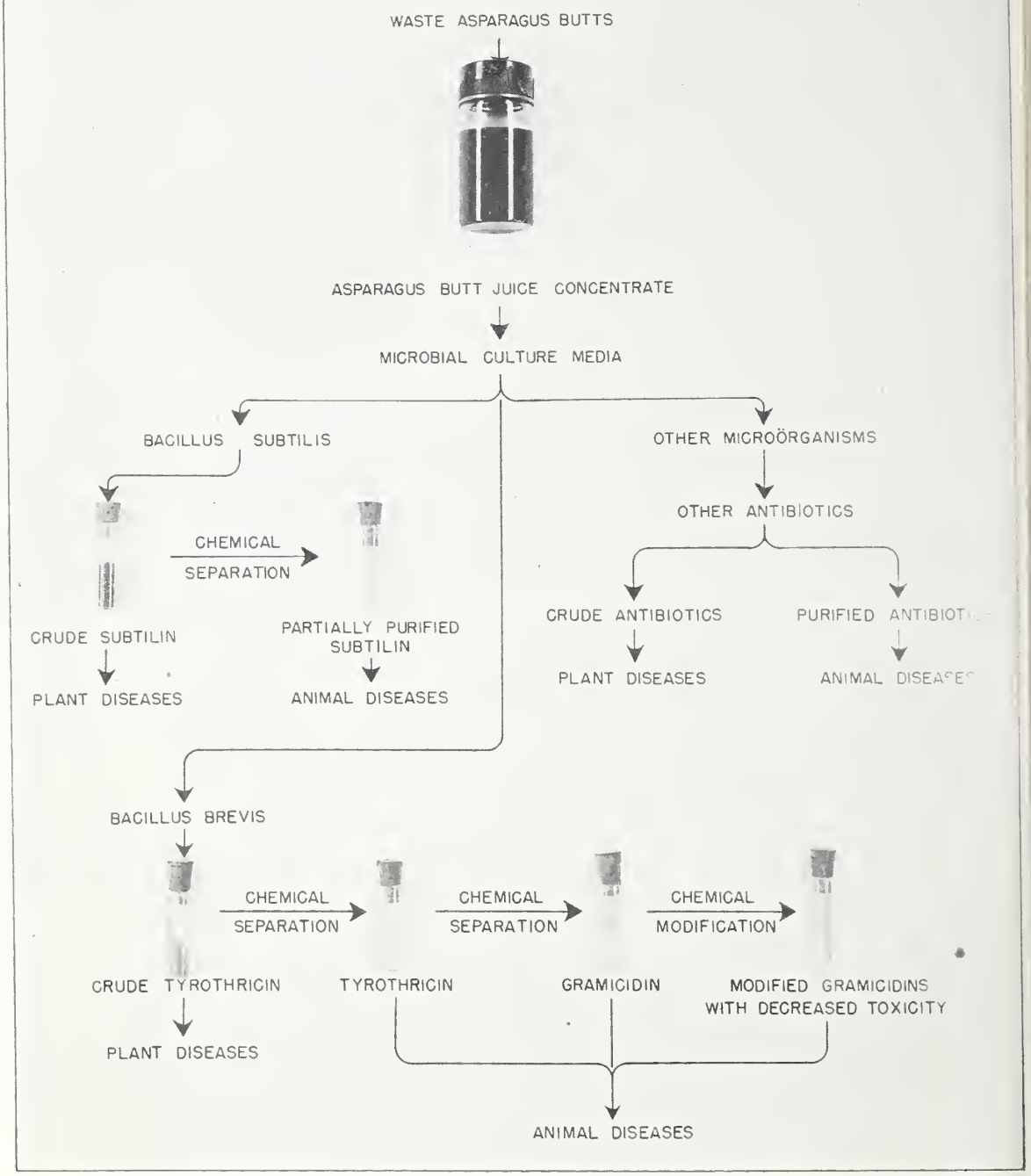
Alfalfa

Poultry products and byproducts

Exhibit Pictures from the Four Regional Research Laboratories

VEGETABLE (ASPARAGUS) WASTE UTILIZATION FOR PRODUCTION OF ANTIBIOTICS

WESTERN REGIONAL RESEARCH LABORATORY BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY



PRODUCTION OF SUBTILIN

WESTERN REGIONAL RESEARCH LABORATORY — BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY

ASPARAGUS JUICE CONCENTRATE

OR

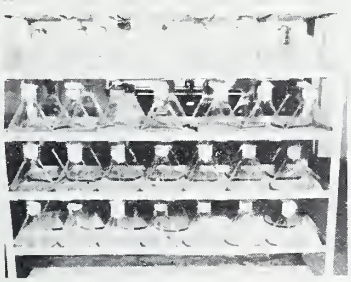
BEET MOLASSES (PLUS SUPPLEMENTS)

DILUTED FROM A CONCENTRATE TO APPROX. 8% - 15% SOLIDS

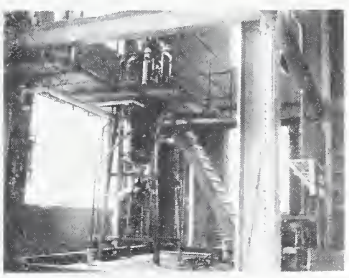
PASTEURIZED BY STEAMING FOR 20 MINUTES OR STERILIZED BY AUTOCLAVING UNDER STEAM PRESSURE

pH ADJUSTED TO 6.8 TO 7.0

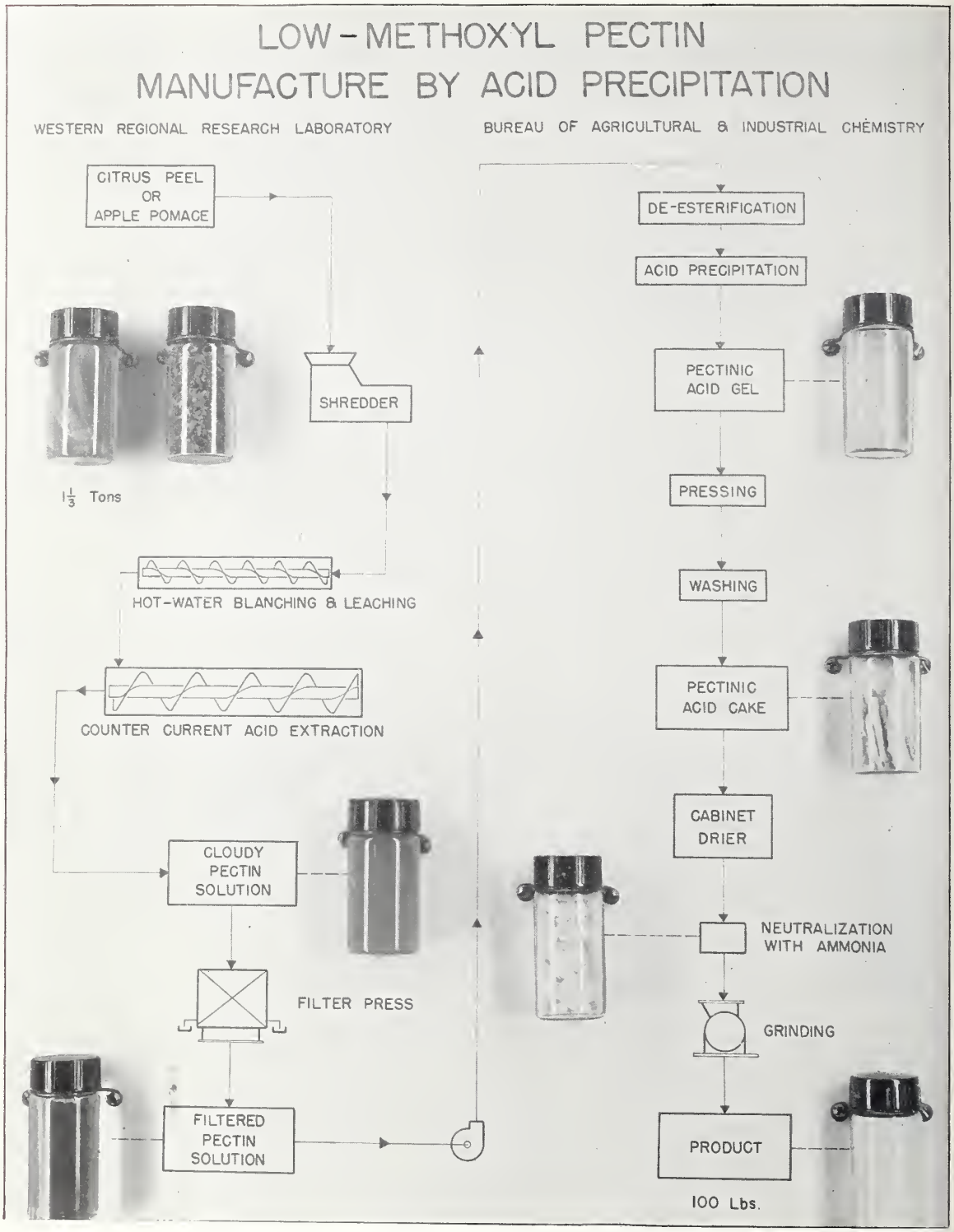
INOCULATED WITH BACILLUS SUBTILIS N.R.R.L. NO. B-543



SURFACE CULTURING IN FLASKS OR SHALLOW PANS.
INCUBATED 24-48 HOURS @ 35°C.
SUBTILIN PRESENT LARGELY IN CELL PELLICLE.
TOTAL ACTIVITY IN CELL PELLICLE APPROX. 0.5 GRAM PER LITER (EXPRESSED IN TERMS OF SUBTILIN STANDARD).
RECOVERY OF SUBTILIN APPROX. ½ TO ¾ OF INDICATED TOTAL ACTIVITY.



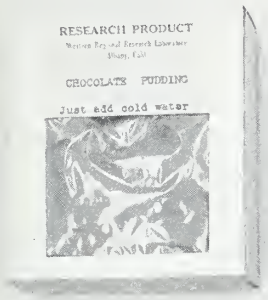
SUBMERGED CULTURING IN TANK.
AERATED VIGOROUSLY 8-10 HRS. @ 35°C.
SUBTILIN PRESENT LARGELY IN CULTURE LIQUID.
TOTAL ACTIVITY OF CULTURE APPROX. 1 GRAM PER LITER (EXPRESSED IN TERMS OF SUBTILIN STANDARD).
IDENTITY OF PRODUCT WITH THAT OBTAINED IN SURFACE CULTURES UNDETERMINED.

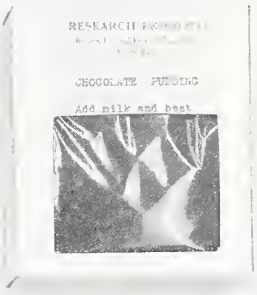

LOW-METHOXYL PECTIN
MANUFACTURE BY ACID PRECIPITATION
WESTERN REGIONAL RESEARCH LABORATORY
BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY
CITRUS PEEL OR APPLE POMACE
1⅓ Tons
SHREDDER
HOT-WATER BLANCHING & LEACHING
COUNTER CURRENT ACID EXTRACTION
CLOUDY PECTIN SOLUTION
FILTER PRESS
FILTERED PECTIN SOLUTION
DE-ESTERIFICATION
ACID PRECIPITATION
PECTINIC ACID GEL
PRESSING
WASHING
PECTINIC ACID CAKE
CABINET DRIER
NEUTRALIZATION WITH AMMONIA
GRINDING
PRODUCT
100 Lbs.

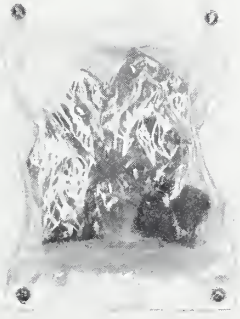
LOW-METHOXYL PECTIN FOOD PRODUCTS

WESTERN REGIONAL RESEARCH LABORATORY BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY

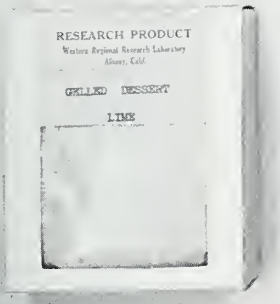
FRUIT DESSERT : JELLIED
(25 MILLION CANS PURCHASED
FOR USE BY ARMED FORCES)

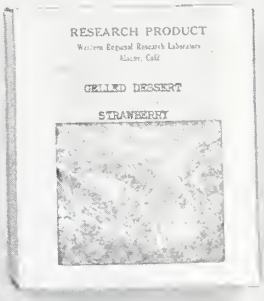


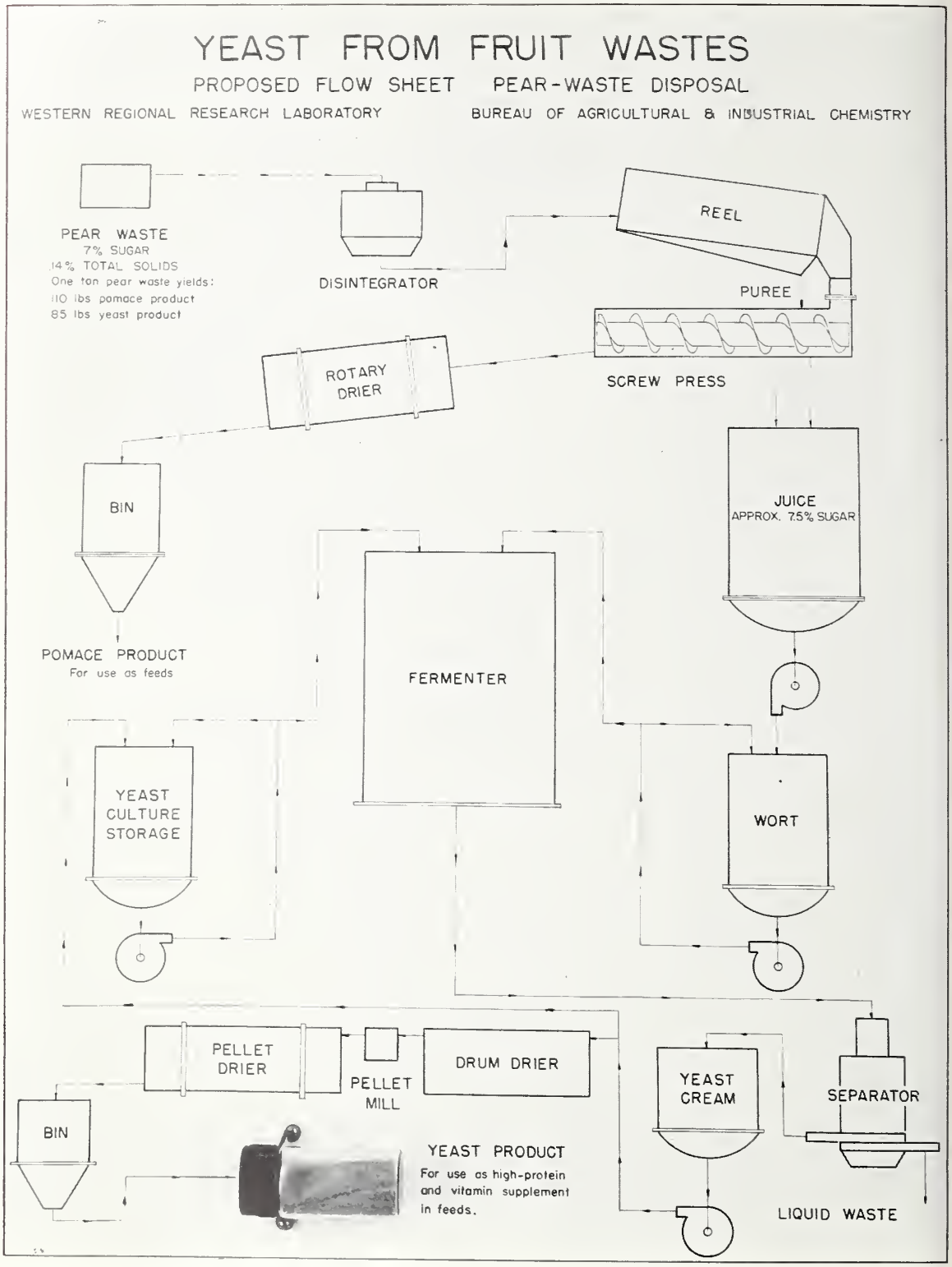




JELLIED CANDY

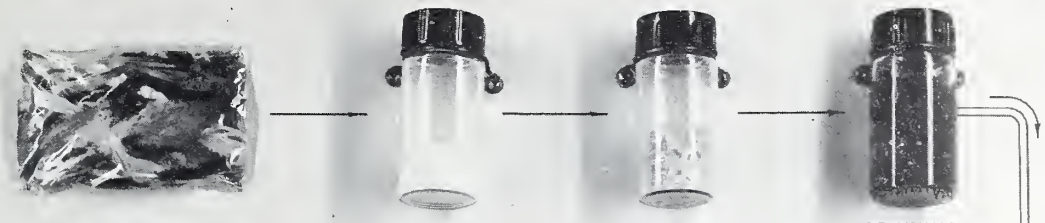





YEAST FROM FRUIT WASTES
PROPOSED FLOW SHEET PEAR-WASTE DISPOSAL
WESTERN REGIONAL RESEARCH LABORATORY
BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY
PEAR WASTE
7% SUGAR
14% TOTAL SOLIDS
One ton pear waste yields:
110 lbs pomace product
85 lbs yeast product
DISINTEGRATOR
REEL
PUREE
SCREW PRESS
ROTARY DRIER
BIN
POMACE PRODUCT
For use as feeds
JUICE
APPROX. 7.5% SUGAR
FERMENTER
YEAST CULTURE STORAGE
WORT
PELLET DRIER
PELLET MILL
DRUM DRIER
YEAST CREAM
SEPARATOR
BIN
YEAST PRODUCT
For use as high-protein and vitamin supplement in feeds.
LIQUID WASTE

FIBERS FROM FEATHERS

WESTERN REGIONAL RESEARCH LABORATORY BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY

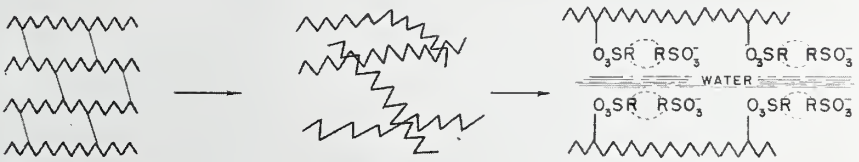


FEATHERS

REDUCING AGENT

SYNTHETIC DETERGENT

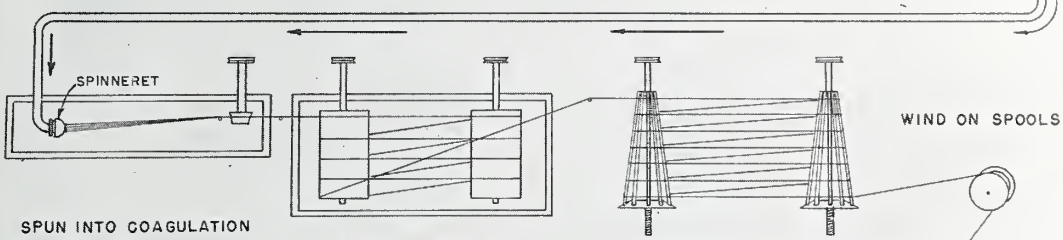
SPINNING SOLUTION



MOLECULAR INTERPRETATION NATURAL FEATHER STRUCTURE

BOND BETWEEN PROTEIN MOLECULAR CHAINS BROKEN BY REDUCING AGENT

ADDITION OF SYNTHETIC DETERGENT TO MAKE SPINNING SOLUTION



SPUN INTO COAGULATION BATH TO FORM A FIBER

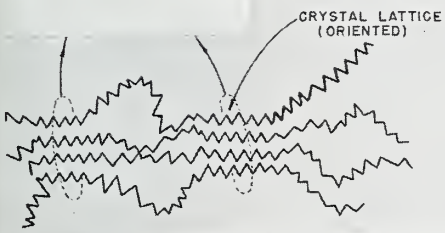
WASH AND STRETCH

STRETCH AND DRY

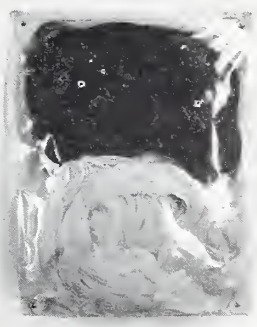
WIND ON SPOOLS

DETERGENT RECOVERED BY SOLVENT EXTRACTION

X-RAY PHOTOGRAPH PROVING TRUE FIBER STRUCTURE OF THESE SYNTHETIC FIBERS FROM FEATHERS



MOLECULAR INTERPRETATION OF FIBER STRUCTURE IN TERMS OF PROTEIN CHAINS

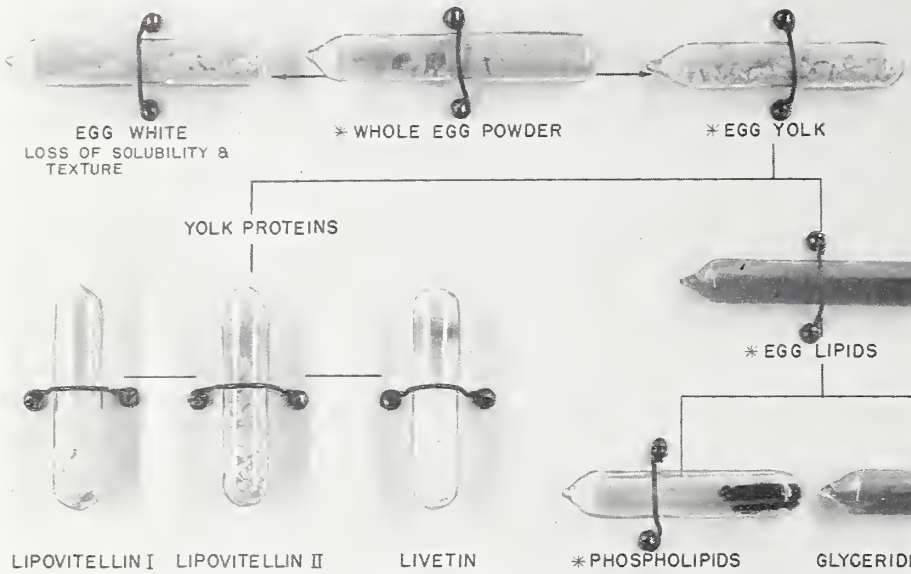


FIBERS

STORAGE LIFE OF DEHYDRATED WHOLE EGG

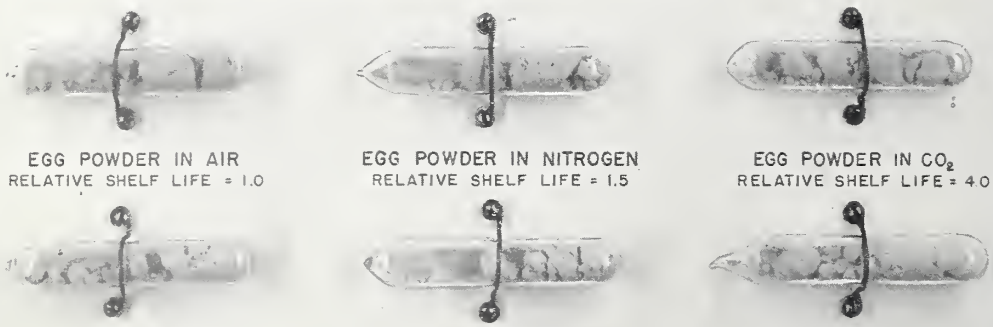
WESTERN REGIONAL RESEARCH LABORATORY — BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY

I DETERIORATION: NATURE & CAUSES



* DEVELOPMENT OF OFF FLAVORS & ODORS

II PREVENTION OF DETERIORATION DURING STORAGE



EFFECT OF IN-PACKAGE DESICCATION ON THE STORAGE LIFE OF DEHYDRATED VEGETABLES

(CONTROLS PACKED AT SPECIFICATION MOISTURE)

WESTERN REGIONAL RESEARCH LABORATORY — BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY

CARROTS

SULFITED

34 DAYS AT 120°F

LIME-PACKED — CONTROL

POTATOES

SULFITED

52 DAYS AT 120°F

LIME PACKED — CONTROL

CABBAGE

SULFITED

26 DAYS AT 120°F

LIME-PACKED — CONTROL

ONIONS

92 DAYS AT 100°F

LIME-PACKED — CONTROL

BEETS

84 DAYS AT 120°F

LIME-PACKED — CONTROL

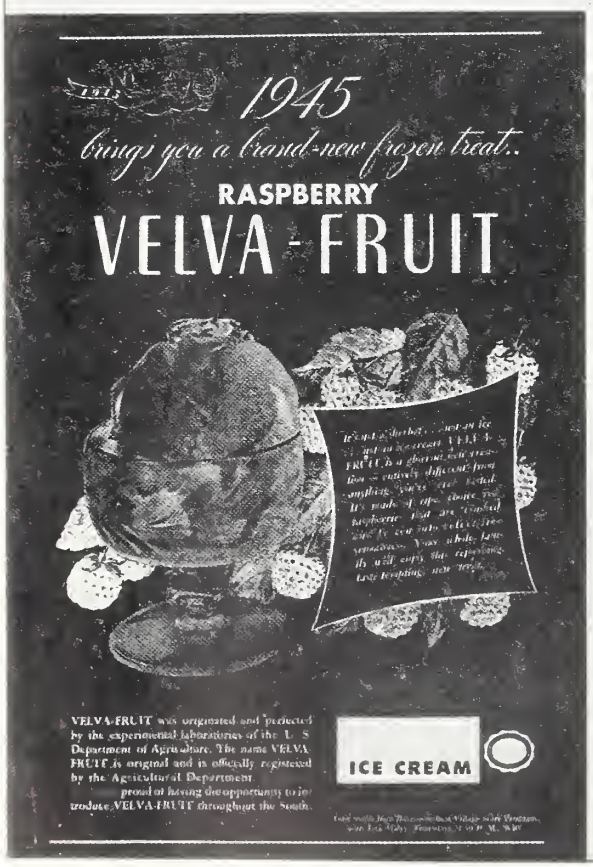
This process has been specified by the Quartermaster General for future Army procurement of dehydrated vegetables

VELVA FRUIT

WESTERN REGIONAL RESEARCH LABORATORY — BUREAU OF AGRICULTURAL & INDUSTRIAL CHEMISTRY

SURPLUS, FULLY RIPE, ODD-SIZED OR BLEMISHED YET SOUND FRUIT CAN BE USED FOR MAKING FROZEN FRUIT PUREE FOR YEAR-ROUND STORAGE AND SHIPMENT.

FRUIT PUREE WITH SUGAR AND GELATIN IS FROZEN IN AN ICE-CREAM FREEZER TO MAKE VELVA FRUIT. ORIGINAL FRESH FRUIT FLAVORS AND VITAMINS ARE RETAINED.



PHOTOSTAT OF NEWSPAPER ADVERTISEMENT

VELVA FRUIT IS NOW IN LARGE-SCALE COMMERCIAL PRODUCTION WITH MANY COMPANIES ALREADY ENGAGED IN ITS MANUFACTURE. THERE ARE EXCELLENT PROSPECTS FOR INCREASED PRODUCTION AS FRUIT AND SUGAR BECOME MORE FREELY AVAILABLE.